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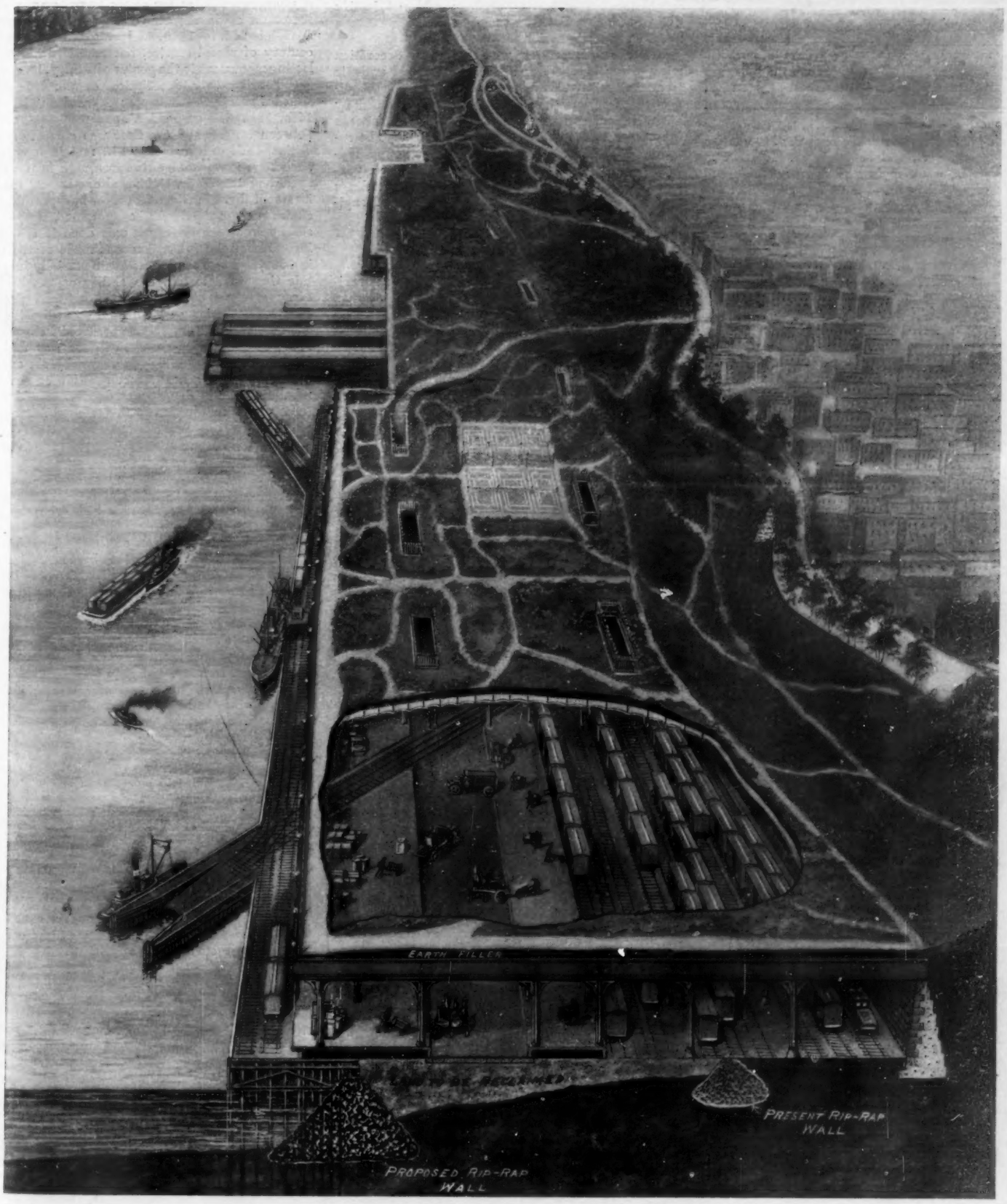

The Commissioners of Parks and of Docks, New York, propose to fill in a strip of the Hudson River foreshore, 200 feet wide and 2½ miles long, between 81st and 129th Streets; build thereon docks, platforms, and railway tracks for steamship freight traffic; roof the structure over; and lay out a park for public use.

COVERING A RIVER'S FRONT WITH DOCKS, TRACKS AND PARKS.—[See page 446.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Artistic Engineering

IT IS deplorable that engineering works, and particularly those of great magnitude, so often, both as a whole and in part, should be wanting in artistic beauty. By way of defense, the engineer will tell you that his structures are works of utility; that they are based on certain inexorable laws of physics; that any departure from these laws can be made only at considerable cost; and that the heavy expense which is inseparable from his work puts him under obligation to use not a pound of steel nor a cubic yard of cut stone or concrete more than the structural necessities of the problem before him demand.

Furthermore, he will tell you that a work which perfectly fulfills its purpose, and does so at a minimum cost, is inherently artistic; and that to change the lines and masses as determined by the structural requirements of the work, and enrich it with artistic embellishment, is at once to violate the strict principles of engineering and rob the completed work of its proper inherent dignity by clothing it with meretricious and unmeaning display.

To a certain extent the engineer is right; to a greater extent he is altogether wrong. Although a well-designed engineering structure does possess a certain dignity, due to its perfect mechanical adaptation to its purpose, it rarely happens that an architect, if called in for consultation, could not suggest certain slight and inexpensive modifications of form, or even the judicious use of architectural decorations, which so far from disguising would rather serve to accentuate the purpose of the structure, and, in their total effect, would therefore add to its dignity and general æsthetic appearance.

If any one doubt this, let him take a look at the architectural features of the two anchorages of the new Manhattan suspension bridge, and the slight architectural iron work ornamentations which have been applied with such good taste at the top of the towers and where the same are intersected by the roadway.

And, by the way, it occurs to us, just here, that the engineer, with much show of reason, might turn upon the architect and remind him that criticism, like charity, should begin at home; for the architect frequently fails to produce a good effect simply for the reason that he has ignored altogether those very principles of construction which the engineer is apt to carry too far. Proof of this is found in many of the lofty office buildings, and particularly those which stand on a square plot of limited area. A building of this character is nothing more nor less than a tower, and in determining the dominating lines of the structure, the architect should emphasize the vertical lines at the expense of the horizontal. As a matter of fact, the majority of tall buildings to-day show that the architect has done exactly the opposite of this; and the result is confused, inartistic, and often positively irritating.

The mediæval builders of Italy made no such mistake, when they planned those lofty and slender buildings which are to-day the delight of the artist and the man with the sketch-pad, camera and note book. Fortunately, there is a growing tendency among American architects to recognize these considerations, which they have applied to some of the later and taller buildings with happy effect.

At the same time, it goes without saying that the architectural or æsthetic embellishment of engineering works should be applied with a discriminating eye and a most sparing hand. Such additions can never enrich unless they truly adorn, and they can adorn only if they emphasize the uses to which the engineering structure is to be put, or the particular function or duty devolving upon its various parts.

The late Sir Benjamin Baker, replying to the frequent charge of artists and architects that the Forth Bridge was inherently ugly, replied that only an engineer, or some one familiar with the principles of engineering, could be a true judge of that question. "The fact that a Corinthian column," said Baker, "is an object of beauty when supporting the entablature of a classic temple, would not justify us in setting it up as a smokestack on an ocean liner."

Better no decoration whatever than decoration misapplied; but best of all is that general æsthetic treatment, with perhaps a slight but judicious modification of form, which can usually be obtained by an intelligent and sympathetic co-operation between the engineer, the architect and the artist. The recognition of this fact is one of the most happy auguries for the constructive work of the future, particularly in the domain of public Federal buildings and the more important municipal works of engineering.

Why We Outbid Europe on Battleships

IN THE article on the upbuilding of our American merchant marine, published in our last issue, Mr. Bowles, the writer, indicated in a brief way the conditions which make it possible for American yards to compete successfully with those of Europe in securing foreign orders for battleships. This is a vital question which has caused no little bewilderment. If our shipyards can build the complicated battleship more cheaply than it can be built abroad, why, it is asked, can they not show a similar or even greater advantage in constructing the simpler and less costly merchant ship?

The answer is to be found in Senate Document No. 438, of the 61st Congress, which contains a letter from the president of the Fore River Shipbuilding Company, addressed to Senator Frye, in which the writer states that in merchant vessels the cost of the vessel to the shipbuilder is divided almost equally between labor and materials, whereas on a battleship from two-fifths to one-half of the cost, depending upon the nature of the design and the extent of the equipment furnished, is in the armor and armament, which the shipbuilder merely puts in place, and which is supplied to him, in the case of the United States vessels, by the Government itself, and in the case of private contracts by a subcontractor. In the case of the hull and machinery, which the shipbuilder provides, the proportion of labor is smaller and the proportion of materials and auxiliary machinery much greater than in a commercial vessel. The shipbuilder's cost of labor is much greater in the United States than in Great Britain and Germany, being placed variously from 40 to 80 per cent greater here than abroad, and this, of course, affects the cost of a naval vessel in the same way that it does the cost of the commercial vessel, but much less in proportion to the total, as explained.

In building battleships abroad, there is considerable competition among the shipbuilders to obtain contracts for hull and machinery, and the prices of hulls and machinery obtained by foreign governments are moderate, but not on such a low basis as they are under the severe competition existing in the United States. The manufacture of armor, guns and gun mountings abroad is confined to a few large concerns and competition between them does not appear to be active. The consequence is that the prices for armor and armament abroad are high.

An examination of the costs of completed battleships for the United States and abroad indicates that the United States Government has been obtaining its vessels always at prices not above those abroad, and in recent years for prices considerably less; the average for the last few years being 15 per cent less for the completed vessel in the United States than in England.

Under these circumstances, the American firm always held an advantageous position in the recent competition for two Argentine battleships; for at their regular prices and with use of their Curtis turbine, which is cheaper and more efficient than the English type, they had a margin in their favor enabling them to offer something better at the same price; which they did and won out on their designs, promising the standard of workmanship set by the United States Navy.

Testing Suspension Bridge Chains After One Hundred Years' Service

WHATEVER other claims Newburyport, Massachusetts, may have upon public interest, the town may surely be proud of the fact that in the old chain bridge across the Merrimac it possessed the most interesting historical structure of its kind in the world. Furthermore, in view of the fact that for one hundred years it stood up faithfully under the ever-increasing burden of highway traffic, this bridge, considered from the engineering standpoint, has made a record that is unapproached, as far as we know, among similar structures of the suspended type. The Newburyport span, erected in 1810, and closed in 1909 after a century of useful service, has remained as the most lasting monument to the genius of Finley, its designer.

According to a description of the bridge published in the Newburyport *Herald* of December 18th, 1810, the suspended span measured 240 feet between towers, and the floor was carried upon ten chains, each of which was 516 feet in length from anchorage to anchorage, the iron used in the chains, anchor plates, etc., weighing altogether 22 tons. It is stated by a resident of Newburyport that the chains were forged on the spot, and that the old smithy in which the work was done is still standing. An official inspection was made of the bridge in 1885, and in 1894 it was again officially inspected, this time to ascertain the ability of the bridge to carry safely the electric cars that had for some time been running over it. The only disaster in its one hundred years of service occurred February 9th, 1827, when some of the chains gave way under the joint load of a laden wagon drawn by six oxen and two horses, and a heavy accumulation of snow. In rebuilding the bridge, it was decided to add two or three chains in addition to the original number. In 1870, when the bridge was eighty years old, a service of heavy electric cars was run regularly across it; but because of the extreme vibration of that half of the roadway over which the tracks were laid, the Roebling Company were called in, and in 1894 the structure was reinforced by 2-inch twisted steel cables.

After the condemnation of the bridge, there was a most interesting investigation by Mr. A. P. Mills, Assistant Professor of Materials, Cornell University, who made a series of tests of the original Norway-iron chain links, to determine their physical condition after a century of continuous service. These tests showed that the average ultimate stress per square inch of the links was 37,550 pounds and the average elastic strength of 23,880 pounds per square inch. It is an interesting fact that the three links showing the highest tensile strength broke with a crystalline fracture, and of the five showing the lowest strength, three showed a fibrous break. Furthermore, the degree of corrosion was found to be greatest on the links showing a very fibrous structure, and it was much less in the links showing a decidedly crystalline fracture.

The chemical analysis of the iron brought out some surprising facts, as will be seen from the following percentages: Total carbon, 0.100; silicon, 0.015; sulphur, 0.007; manganese, 0.006; phosphorus, 0.055; copper, 0.350; nickel, 0.040; tellurium, trace; slag, 0.220; iron (by difference) 99.207. This analysis shows the silicon, phosphorus, and especially the manganese and sulphur to be very low; which is not surprising, in view of the purity of the ores of Sweden and Norway. Very surprising, however, was the discovery that the slag amounted to only 0.22 per cent, since this iron must have been made either in a Catalan forge or some other primitive type of charcoal hearth.

The most significant discovery was the existence of 0.35 per cent of copper in the iron, and Mr. Mills is of the opinion that the crystalline fractures were primarily due to the presence of the copper. He also believes that the freedom from corrosion was due largely to the presence of the copper and not merely to the purity of the iron. This view is supported by the fact that the most badly corroded links invariably reveal a fibrous structure, while those which showed a coarse, crystalline fracture were most remarkably free from corrosion.

By no means the least interesting fact concerning this venerable structure is the circumstance that, at the close of its one hundred years of service, it should have yielded in the laboratory of the physicists a distinct contribution to our knowledge of the strength and properties of materials.

Charles Proteus Steinmetz: An Appreciation

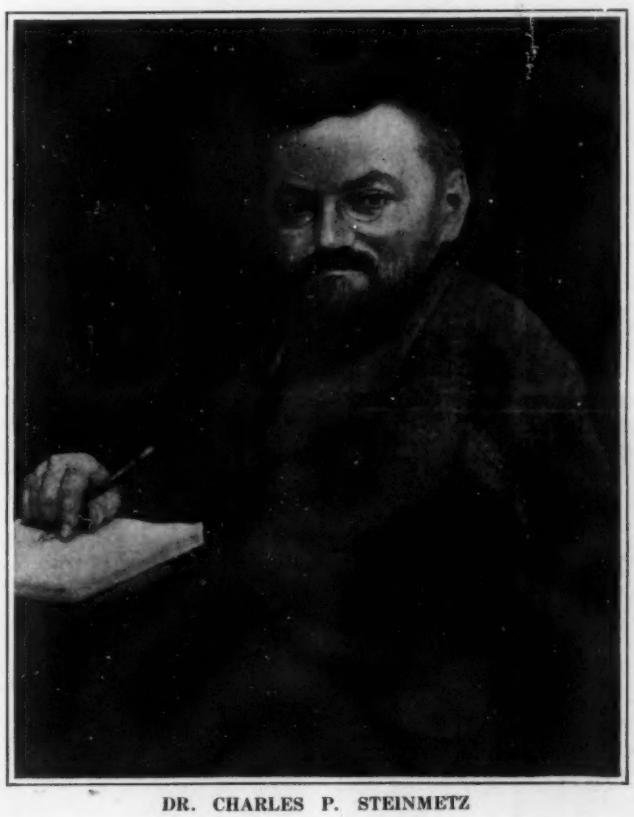
A Great Electrical Engineer

By Joseph B. Baker

DR. STEINMETZ, Chief Consulting Engineer of one of our largest electrical companies, is an inventor of extraordinary talent, and at the same time a remarkably wideawake man of affairs in the big field that he has made for himself, and he is one of the kindest-hearted men in the United States. Without doubt the foremost living protagonist of modern inventing as a branch of manufacturing, his work, and the self-effacing way in which he does it, are an inspiration to young men who are forming their ideals.

Charles Proteus Steinmetz was born April 9, 1865, at Breslau, Germany. He was educated at the Breslau gymnasium and university, studying mathematics, astronomy, physics, chemistry, and other branches, including national economy. Having participated in the social democratic agitation, he incurred the displeasure of the government and escaped to Switzerland in 1888, and there studied mechanical engineering at the Polytechnicum of Zurich. In 1889 he emigrated to America, and found a position with the Eickemeyer-Field Manufacturing Company, first as draftsman, then as electrical engineer and designer, and finally on research work in charge of the Eickemeyer laboratory. With the absorption of the Eickemeyer interests by the General Electric Company, Mr. Steinmetz was attached to Mr. H. Parshall's calculating department in Lynn, Mass. With the transfer of the company's headquarters to Schenectady, N. Y., in the spring of 1894, Mr. Steinmetz organized and took charge of the calculation and design of the company's apparatus, and of the research and development work. Since 1902 he has been Professor of Electrical Engineering at Union University, at the same time retaining his connection with the General Electric Company as Consulting Engineer, and has in the last year again entered in closer relation with this company by organizing and assuming charge of a Consulting Engineering Department.

Even the briefest contact with Dr. Steinmetz reveals a singular individuality, and that of a very high order. The impressions one develops are: A man of fine and ready mind, and one crammed full of the passion for work; a scientist, persistent, even relentless in the pursuit of any idea which engages his attention at all; and an individuality which combines authority in utterance with a remarkable childlike personal humility. To attend one of the regular winter meetings of the American Institute of Electrical Engineers, Dr. Steinmetz comes down to New York as zealously as any young electrical student, and he brings with him enough ideas to equip a full convention of a national academy of science. Perhaps the occasion is the presentation of a paper on high-voltage surges in electric power transmission lines. While the members are assembling, he may be seen hobnobbing with distinguished inventors and obscure members, with the same wholly unconscious feeling of good-fellowship and enjoyment of the evening expressed to the one as to the other. Once the serious business of the evening has commenced, however, he listens; and when it comes time for the discussion of the paper, then arrives the real opportunity to see the man in action. It has become the generally accepted custom to ask Dr. Steinmetz to close the discussion at meetings of scientific bodies. At the Institute, when he is called upon, it is with a feeling of affectionate enthusiasm that one sees him rise to his feet and begin one of his marvelous disquisitions, making history with every word that he utters, and, at the very last, crystallizing the scientific thought that had been in solution as the sense of the meeting, or, on frequent occasions, leading and instructing the general thought and "laying down the law" with the irresistible finality of Daniel Webster speaking in the Senate of the United States. The resonant voice, the quaint accent, the ultimate clearness and force of the phrases, the close-knit reasoning advancing with rapid but definite steps toward an unanswerable conclusion—that is Dr. Steinmetz, thinking on his feet. With a singular feeling one listens to it all, and one goes away with the impression—nay, the conviction—of having spent an evening in the actual presence of a genius. Dr. Steinmetz's main activities center in his life at Schenectady, N. Y. In his employment by the electrical manufacturing company which has been so fortunate as to enjoy his services for many years, he is very much of a free lance. His time is divided between his office at the factory and his home in the park-like new section of this old Dutch town. He comes to his office by appointment, for the most part, to take part in some conference on fundamental manufacturing policy, electrical or mechanical theory, or other important matters; but it is the writer's impression that he prefers the working atmosphere of his own home, where he has a well-equipped laboratory. Dr. Steinmetz's house and his laboratory and his wonderful greenhouses constitute one of the "show places" of Schenectady, and an account of them might make an article by itself. But wherever he may be, he is the most approachable man in Schenectady County, and at the same time the man most forcefully insistent—relentless is the word again—in sticking to the main point of the interview. The writer well recalls an occasion when, as associate editor of the *General Electric Review*, he had received for publication from Dr. Steinmetz some notes on the theory of the steam turbine. An interview was necessary in order to expand the subject into an article, and this interview, which took place on the veranda of Dr. Steinmetz's home, was packed about as full of interest as one might imagine an interview would be with the German Kaiser on military subjects, or with Colonel Roosevelt on hunting in Africa.



DR. CHARLES P. STEINMETZ

Dr. Steinmetz's published works exemplify his faculty of helpfulness. They not only instruct the mathematician, who too often regards engineering problems merely as opportunities for the exercise of his science for its own sake, but they delight the practising engineer, who ordinarily prefers to make a shrewd, intuitive guess at the whole result, in dealing with his problems, rather than "bother with mathematics." In Steinmetz's numerous electrical papers, many hitherto obscure departments of electrical engineering are reduced to an exact science by original and effective methods for the precise calculation and predetermination of apparatus and phenomena. Most of these papers have been published in the Transactions of the American Institute of Electrical Engineers. Thus in his most recent work, "Engineering Mathematics," he dwells on the importance of adapting the mathematical tool to the work in hand, and gives numerous excellent suggestions which help the reader to apply analytical methods to engineering problems. His text is illuminated by common sense, elucidated by well-chosen analogies. Dr. Steinmetz's work includes more than the public will ever come to realize, and it resides largely in bringing out the best work of others. This is true especially of his inventive work, which more often takes the form of pregnant initial hints for others to follow up, and of illuminating suggestions in conference on inventions initiated by others, than of "inventions" in the ordinary sense, credited to him from start to finish. In this respect he is a worthy compeer of Faraday, who was content to discover and announce the fundamental laws of magneto-electric induction, and leave to others the building of dynamo-electric machines and electric motors.

One of his numerous occupations is that of Professor of Electrical Engineering in Union College, and it would be difficult to decide which is the greater personal treat, to sit in the classroom and listen to the scientist's illuminating explanations, or to foregather with the college boys at some fraternity meeting and see him circulating through the crowd, encouraging one, perhaps tactfully rebuking another on some point of electric lore, or again sitting in their midst and beaming with happiness at the good time everyone is having, like the veritable father of the college community that he is.

What is the secret of his unexampled abilities, and of his equally unexampled practical application of these abilities in an intensely modern world of concrete performance where, to live and move and have any being worth the name, the scientist must keep his feet on the earth, even if his head is in the clouds? The answer is as simple as the nature of the man himself. From the time he was "discovered" by far-seeing officials of the old Thomson-Houston Electric Company, after a strenuous apprenticeship in the Eickemeyer-Field laboratory, Steinmetz has developed this truth—that there are plenty and plenty of right ideas in the infinite realm of mind, and that he best brings out these ideas who does not try to scrape some of them off and hoard them away, selfishly, but simply to perceive them, bring them out through his own or others' work, and pass them on to the world with his individual benediction.

Cholera and Immigration

DURING the year 1910, cholera attacked 214,000 persons in Russia, with a mortality of 46 per cent, and claimed 5,000 victims in Turkey. There was an epidemic of cholera in Naples, and four cases were reported from Marseilles. In general the disease continued to advance westward, and there is no hope that it will be extinguished in all of the places where it existed at the beginning of the present winter. In a communication to the Paris Academy of Medicine, Drs. Chauteuesse and Borel cite several facts which prove that cholera can be carried in a latent form and demonstrate the important part played by immigration in the propagation of the disease. Germs of cholera have been found in persons 30 days after their departure from an infected district.

Boracic Acid

FORMERLY all the boracic, or boric, acid of commerce was obtained from borax by heating it with calcined ferrous sulphate in closed vessels, whereby sodoforic acid was formed, and boracic acid was carried on with the watery vapors, which escaped.

This was a long and tedious process, and not much progress was made until it was discovered that boracic acid could be obtained from the boiling springs and jets of vapor in Tuscany. Long after the discovery of boracic acid in these springs, the brilliant idea struck the physicist as well as the chemist to employ the heat of the natural steam jets. This method had the effect of converting an unprofitable branch of industry into one of the most successful.

The lagoons are situated near the top of one of the highest hills. As the volcanic vapors pass through the waters of the lagoons the boracic acid is arrested by the water, which becomes impregnated with it. In California it occurs as the mineral sassolite, and as a saline incrustation on the crater of a mountain in the Lipari group, north of Sicily.

Heat from Dust

Utilization of Low Grade and Waste Fuels

By Charles L. Wright

Fuel Engineer in Charge of the Fuel Briquetting Investigations of the United States Bureau of Mines

THE natural resources of our country have been considered so inexhaustible that it is only very recently that the attention of the public has been directed to the enormous amount of material wasted in our various industries; and it is to be hoped that the so-called conservation movement may continue until we, as a nation, reach the industrial efficiency that has been attained by the older countries—Great Britain, Germany, France, and others. Furthermore, it is to be hoped that we may not wait as these countries have until the most valuable resources are gone forever, before putting this conservation process into effect.

According to the United States Geological Survey's report, 459,209,073 short tons of coal were produced in the United States in the year 1909, of which 83,000,000 short tons were anthracite coal from Pennsylvania.

In the eastern section of the United States, where most of the coal is mined and used, the price of the better grades of coal is steadily increasing. It is now estimated that the maximum tonnage of anthracite possible to produce annually has nearly been reached. If this is true the price of this popular domestic fuel will in a few years place it out of reach of all but the wealthy for a domestic fuel. Then people must look for some other kinds of fuel which will be suitable for household use.

On the other hand, the demand for industrial fuel is increasing more rapidly than the development of coal mining, and therefore manufacturers are already on the lookout for a more economical fuel in order to reduce the cost of production, or at least to keep it from being increased. Our industrial prestige is due in no small measure to our having had great natural fuel resources; and as competition becomes keener with other nations and the price of our fuels is at the same time advancing, we must make use of the cheaper fuels and fuel wastes in order to hold our present position.

The purpose of this article is to discuss in a general way the various materials suitable for fuel which are now wasted or considered of small value, and therefore disposed of at a low price; and to discuss the ways that such wastes may be utilized to better advantage.

The following fuel wastes and low grade fuels are considered in this article: Bituminous slack, anthracite culm, coke breeze, sawdust and wood waste, lignite coal and peat.

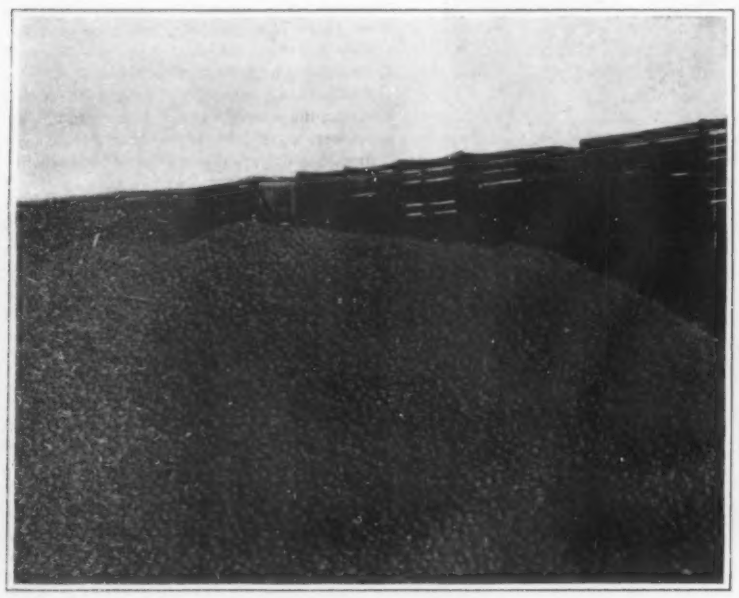
Bituminous Slack. Most companies mining bituminous coal screen all or part of their product before shipping, to remove the dust and finer pieces of coal which is called "slack." The size of the opening in the screen used varies with different operations, but the size of opening most commonly used is ¾ of an inch; so generally speaking slack is that portion of the mined coal which passes through the screen with ¾ inch openings.

As high as 50 per cent of the coal mined is in the form of slack. Formerly there was no market for this slack, and it was dumped in piles near the mine and accumulated from year to year. These piles of slack were sometimes set on fire to get rid of them, and would smolder away for years.

At the present time there is in certain parts of this country, for example the eastern and middle States, a market for this slack coal for use in special furnaces, as an industrial fuel. There is not, however, a market large enough for all the slack produced, and in many places, if it is sold at all, it is sold at a price which is less than the cost of producing it, the profit of the business being made from the sale of the larger sizes. Around Pittsburg slack may be had in carload lots for 85 cents to $1 a ton delivered at the plant. In other States it brings 15 to 50 cents per ton, loaded on cars at the mine. How this waste by means of briquetting and the gas-producer can be converted into desirable household fuel and power will be described further on in this article.

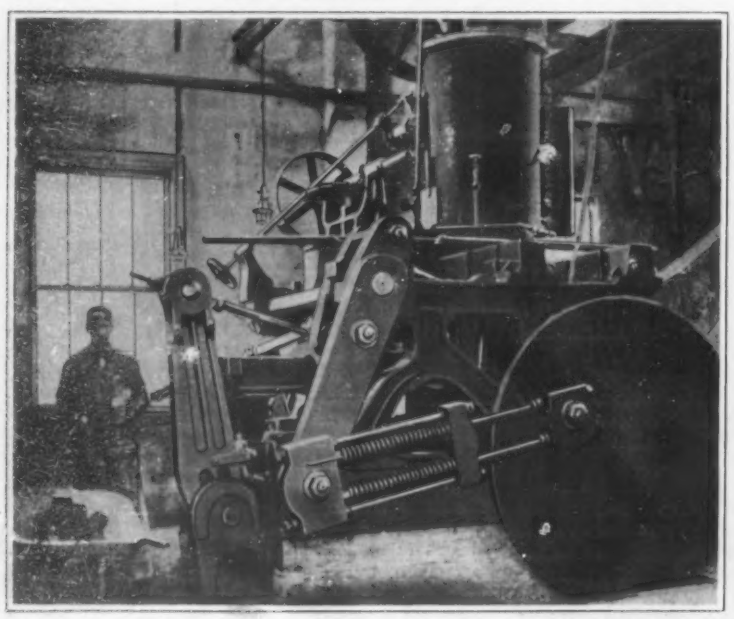
Anthracite Culm. Anthracite culm is similar to bituminous slack in that it composes the smaller sizes of anthracite coal. As with bituminous coal these finer sizes were formerly a waste material, and in the anthracite fields of Pennsylvania to-day there are great hills of this culm which have accumulated for many years. Anthracite culm however possesses the advantage over bituminous slack that it produces practically

(Continued on page 456.)

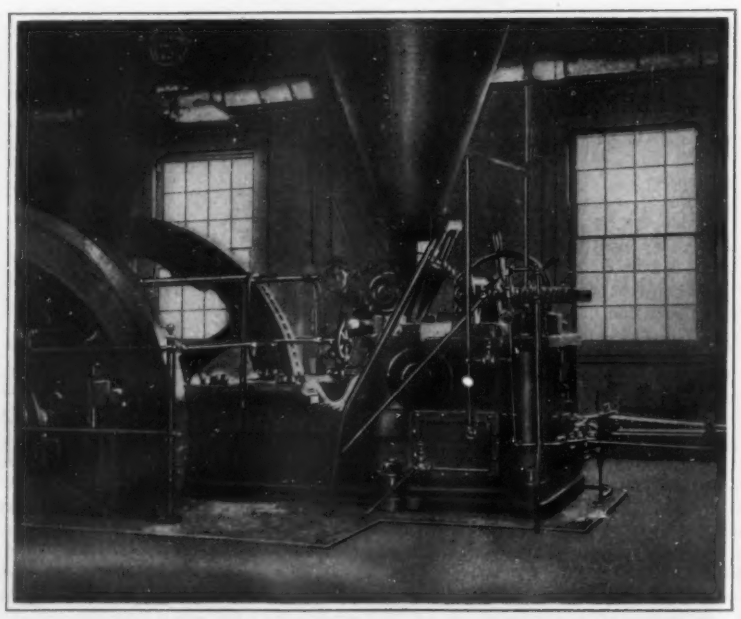


A pile of clam-shaped fuel briquets.

A typical fuel-briquetting plant.



Briquetting machine of English make. Note the briquets in the wheel-barrow.



A German type of briquetting machine used by the United States Bureau of Mines.

UTILIZATION OF LOW GRADE AND WASTE FUELS

The Biggest Ship and the Biggest Dock

By the English Correspondent of the Scientific American

IF ever the term "superlative" was justified in speaking of engineering works of magnitude, we may surely make use of it in connection with the recent opening of the new graving dock at Belfast, Ireland, by the admission into the structure of the White Star liner "Olympic," when the greatest ship in the world was safely berthed in the world's greatest masonry dry dock. The dock was constructed through the foresight and enterprise of the local authorities of the Belfast harbor.

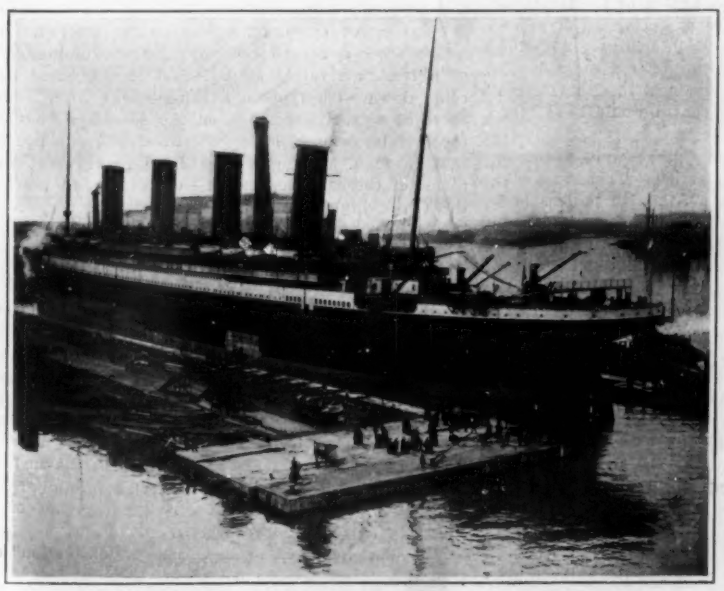
The main contract for the work was entered into late in the year 1903, and active work was commenced early in 1904. During the intervening seven years a large force of men has been continually at work, and the magnitude of the operations may be judged from the fact that upward of 300,000 cubic yards of sand and clay had to be removed, and that in the excavation thus made there has been formed a water-tight masonry basin nearly 900 feet long and 100 feet wide, into the construction of which entered 76,000 cubic yards of concrete, 24,000 cubic yards of brickwork, and 36,000 cubic yards of cut granite. The contract called for the completion of the work in three years and four months from the date on which construction began; but two serious subsidences in the large Alexandra graving dock alongside delayed the work, so that about seven years altogether have been occupied in the construction. The Alexandra dock, one of the largest in the world, is 80 feet wide at the entrance, 50 feet broad on the floor, with a floor length of 800 feet. The new dock is 96 feet wide at the entrance, 100 feet wide on the floor, and 850 feet long on the floor when the caisson gate is placed in its normal position at the entrance. By floating the gate out and placing it against the outer face of the dock entrance, the total length on the floor is 887½ feet.

In view of the constantly increasing length of ocean liners, the construction of the dock has been carried out in such a way as to permit of the permanent lengthening of the structure to the extent of 200 feet. Whenever this is done, a normal length of clearance will be available of 1,050 feet, sufficient to comfortably accommodate the much-talked-of 1,000-foot ship of the future.

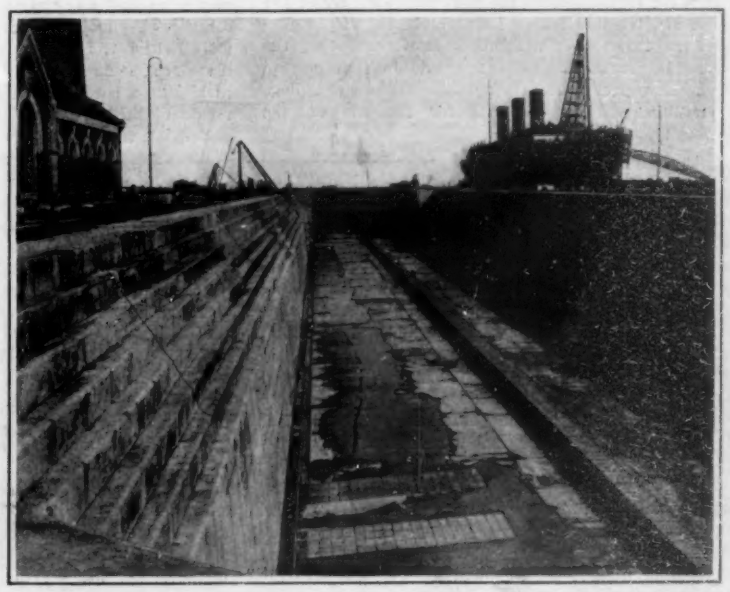
The following further particulars will be of interest: The width at the coping level is 128 feet, and at the lowest altar course 104 feet 6 inches; the depth of floor at center below level of high water of ordinary spring tides is 37 feet 3 inches; the top of keel blocks below level of high water of ordinary spring tides is 32 feet 9 inches; height of top of blocks above floor, 4 feet 6 inches; level of entrance sill above floor at center of dock, 2 feet; bottom of floor at sides of dock below coping level, 43 feet 6 inches; thickness of floor at center, 17 feet 6 inches; thickness of side walls at bottom of battened face, 18 feet 9 inches.

The emptying of a dock of this huge size calls for a powerful pumping plant, and three engines, each of 1,000 horse-power, working together, are able to pump the dock dry in one hour and forty minutes, even when there is no vessel in the dock. To do this necessitates drawing out about twenty-three million gallons of water. The auxiliary plant is built on the same generous scale. Thus, the hydraulic capstan equipment consists of three, each of 30 tons capacity, and two of 11 tons—big units, it is true, but none too large for handling ships of the size of the "Olympic" and "Titanic." The next largest capstans are found at the Admiralty yards, each of which is only 16 tons capacity.

The old system of hinged swinging entrance gates is no longer used on modern dry docks of large capacity, their place being taken by floating steel caissons. The gate for the new dock is a massive rectangular structure, which, when the dock is open, is contained in a recess on the west side of the entrance. It travels upon two lines of heavy rollers, set on the floor of the dock, and is moved across the entrance by special hydraulic appliances, the opening or closing being done in about five minutes' time. When a vessel as long as the "Olympic" is to be docked, the



After the "Olympic" had entered the dock the caisson gate was floated across the entrance and the water pumped out by two 1,000-horse-power engines.



View showing the long perspective of the dock with the nearly completed "Olympic" alongside.

caisson is floated out and placed against the granite faces of the outer entrance sill, thereby adding 37½ feet to the normal length of the dock. On the floor of the dock, along its central longitudinal line, are 332 massive cast-iron keel blocks, with timber capping pieces. These blocks receive the entire weight of 38,000 tons of a vessel like the "Olympic," when they carry her huge bulk without the least injurious strain upon the ship's structure. It may be mentioned that the overall length of the "Olympic" is 882½ feet, its breadth 97 feet 4 inches, and its gross tonnage, 45,000.

Covering a River's Front with Docks, Tracks and Parks

A PRESSING need which is forcing itself upon public attention with an ever-increasing demand is that for adequate and properly disposed dock facilities at the port of New York.

Also, the city is suffering from the results of one of those many hastily-granted franchises of the earlier years of its history, which are now presenting obstacles to the city's growth, to say nothing of other disadvantages which were little thought of at the time the concessions were granted. We refer to the fact that the New York Central Railroad Company's freight lines extend along the westerly shore line of Manhattan, from the north of Manhattan to within a mile or so of the Battery.

The lack of proper dock accommodations is very injurious to the port of New York, and the presence of the New York Central tracks, running, as they do, at street level, is at once an offense to eye and ear and nostrils, and, as the annual death list shows, a peril to human life.

Dock Commissioner Tomkins and Park Commissioner Stover have united in presenting to the city authorities a plan by which the railroad tracks, where they front upon the beautiful Riverside Drive and Park, shall be hidden from view and an additional two miles of dock frontage provided, with suitable landings for cars and the proper track facilities for the distribution of the freight; while, in addition to this, a strip of park land 200 feet wide and 2½ miles in length, will be placed at the disposal of the city.

We present on the front page of this issue a bird's eye view showing the salient features of this proposed improvement. At an average distance of 200 feet out from the present shore line, a riprap wall will be built, and the intervening space filled in with suitable material. Adjacent to the present tracks of the New York Central Railroad space will be reserved for two additional tracks, to be built by the company when the increased traffic of the future calls for them. Then, in their turn, will be constructed three municipal freight tracks, a broad loading and unloading platform, a driveway for vehicles, a wide platform for receiving river and ocean freight, and, finally, along the dock front will be a pair of tracks for the use of freight unloaded from or to be delivered to steamships.

The whole of this area, up to the edge of the steamship loading and unloading platform, will be covered by a massive steel and concrete roof, and upon this will be laid a covering of earth of sufficient depth to meet the requirements of a park, and support a growth of turf, shrubbery and trees. The park, as thus formed, will be laid out with walks and windings paths to conform to the pathways existing on the slopes of Riverside Park. Large openings will be provided at intervals for lighting and ventilating the covered-in tracks and roadways, and in that portion of the new park which is opposite Columbia College a stadium will be laid out for the use of the university.

It is the expectation of the commissioners that practically all of the rock required for the riprap, and one-sixth of the earth necessary for filling purposes, will be obtained from the excavations of the proposed Lexington Avenue-Broadway subway. The remaining material, about one million cubic yards, can be obtained from selected materials, such as clean ashes, of the Street Cleaning Department, and from the various excavations for buildings in the district bordering on the proposed work.

There is a precedent for this improvement to be found in such cities as Antwerp and Vienna, where the water front has been so judiciously improved that its commercial value has been increased, and its artistic development greatly promoted.

The plan of operation in receiving and distributing freight will be as follows: Car floats carrying freight received at Jersey City on the roads which terminate there, will be landed at the diagonal piers at each end of the new pile wharf. They will be switched to the water front tracks, if they are destined for water transportation by ship or river steamer, or to the inshore municipal tracks if they are intended for transfer by the municipal railroad to the city, the reverse operations taking place for outbound freight. The freight from shipping will be unloaded to the platfrom adjoining the water front tracks, there examined by the customs authorities, and then either loaded to the water front tracks for railroad handling or taken away by trucks on the roadway.

In conclusion, it should be noted that electric traction becomes a positive necessity where so many tracks, carrying a heavy freight traffic, are to be roofed over. It can thus be seen that the long-talked-of nuisance of noise and smoke, which has troubled the residents of Riverside Drive, will be by the proposed method effectively abated.

Cyrene and Dr. Herbert de Cou

By Prof. Alfred Emerson, Chicago Art Institute

SIMON of Cyrene, who carried the Saviour's cross, preserves a pale memory in Christendom of his native city, once the capital of Greek Africa. A number of Dorian islanders planted a European colony on the great Libyan headland to the south of Greece proper 640 years before Christ. Thus, to the Arab conquest of North Africa, A. D. 640, Cyrene and the Cyrenaica had a longer history than ancient Rome itself. There, too, a dynasty of kings gave way to republican government. Sometimes the Libyans pressed the Greek colony hard. But Greek Africa prospered. Cyrene had its own school of philosophy and a famous school of medicine. The poet Callimachus, the learned Eratosthenes, and Synesius, one of the most elegant divines of the early Christian church, were Cyrenians. The city had over 100,000 inhabitants. The Ptolemies gave kings to it again. They favored the ports of Apollonia, Ptolemais and Berenice (now Tolmeïtah and Bengazi) at the inland city's expense. Trajan's harsh repression of a Jewish rebellion in the Cyrenaica was Cyrene's "finish." It has no Moslem history like Bengazi and Tripoli. Nomad Bedouins and Cretan squatters now dispute possession of the ruins at Grennah.

An Italian doctor, Della Cella, accompanied the Pasha of Tripoli to the Cyrenaica overland about 1800. His relation is about the first modern account of the country. Lieutenants Smith and Porcher of the British naval service explored its principal antique ruins in 1861, and enriched London with some fine marble sculptures of late period. But these were mere surface gleanings. Foreign consuls and vice-consuls have exported some fine painted vases from Bengazi, and so have the Turks.

What a country for a thorough archæological exploration! The writer visited Tripoli and the Cyrenaica with Mr. Joseph Thacher Clarke in 1886. A native land-owner told us that there are 20,000 unopened tombs near Grennah. But the Turkish Governor at Bengazi favored our project of reconnoitering them so little that a couple of notorious malefactors were engaged to "get" any foreigners offering to examine the ancient ruins even with eyes, let alone with a machine. Small encouragement for two unpolitical travelers who had braved the discomforts of a Turkish troopship to reach the region from Tripoli, and would reach Candia only by an eleven-day voyage under sail! In short, all we saw nicely was the cave of Lethe, at a short distance from Berenice, where Herakles outwitted the dragon of the Hesperides. But we did ascertain that the current stories of hostile Arabs were pure rubbish. A Turkish garrison of 5,000 men squelched any native disaffection or foreign meddling with equal ease, always excepting an irrepressible British consul's unwelcome interference with the slave trade. It is true that they offered me a black girl with a coral button in one nostril. But I have no doubt that my friend the consul would have compelled me to release her.

We know that the kings of Cyrene were generous patrons of the best Greek artists. Theban poets, Cretan statuaries, Spartan and Athenian potters and vase-painters served them gladly. A famous "Cyrenian" wine cup in Paris shows a sixth century king of Cyrene superintending the weighing and storage of the silphium crop in person. The picture has been called a political caricature on account of its grotesqueness. Théophile Homolle found the bronze statue of another King of Greek Africa at Delphi in 1896. It commemorated a royal success at the Pythian chariot races of 462 B. C. We know nothing of Cyrenian art proper as yet, except the Cyrenian coinage. The painting and the sculpture named previously were by peninsular Greek artists. The Cyrenian mint-masters embellished gold and silver pieces with the emblems of Cyrene's religion and commerce. I saw a splendid head of Alexander-Ammon and a graceful stalk of silphium on the two faces of a Cyrenian tetradrachm, now serving as a hatpin head, the other day.

The veil which the Ottoman government has chosen to draw around the Cyrenaica is lifting at last. Messrs. Allison V. Armour and Richard Norton have used the former's yacht "Utowana" to reconnoiter the ruins of Apollonia and Cyrene within a few years. Dr. Norton's persistent solicitations at Constantinople have won him the much-coveted firman to conduct excavations there, still more recently. He took the two foremost American connoisseurs of Greek bronzes and terra cottas back to North Africa with him last fall, Herbert Fletcher de Cou and Hoppin.

The expedition was working along the line of an ancient road well lined with tombs and other constructions, when its friends had the tragic news by cable of Dr. de Cou's assassination by Arab ruffians on March 11th. We hope Secretary Knox will have the case of the murdered American explorer examined with condign energy. The British occupation of Candia exposed the devious ways of Turkish tribunals when Moslems have murdered Christians. The responsibility of the Turkish authorities for the slaughter of an accredited foreign excavator must be sifted. The American scholars appear to have omitted no customary precaution. It is known that they had a Turkish military escort, originally of 60 and afterward of 10 men. All three of them, moreover, possessed a practical experience of research work in the Levant, having won their spurs under Charles Waldstein at the time he excavated the Argive Heræum for the Archæological Institute of America. Nobody spoke Greek better than Dr. de Cou when he chose to. And Greek is the native vernacular of a considerable element in the sanjak of Bengazi, where Sultan Abdul Hamid colonized many Mohammedan Cretans after yielding to Crete a few years ago. I have seen De Cou hold an Athenian policeman spellbound with his whimsical eloquence. He was the quietest of men, too, a teacher who keyed his voice too low to be heard in his own college classroom. This had something to do with his serving the American Schools of Classical Studies at Athens and Rome for several years, as secretary and librarian. Chicago, where he leaves a mother and a brother, afforded no scope for his particular talents. During the last year or two he traveled with Mr. James Loeb of New York, whom he assisted with his antique collections. His knowledge of Greek philology and archæology was most exact. When acting as examiner on a competitive Athenian fellowship award fifteen years ago, I was staggered by the uncanny fullness and accuracy of one set of answer papers in sight Latin and Greek, Greek syntax and history, Mediterranean geography, colloquial Greek, on how to date ancient inscriptions, and what not. That was Herbert de Cou. He carried the same uncanny accuracy into his active scholarship. His illustrated publication of the bronzes discovered near Argos by the American excavators of the Heræum is an example of it. He conducted everyday inquiries in the same spirit. De Cou once prepared a small *catalogue raisonné* of Athenian wet-nurses for the convenience of an American baby. How a bachelor came by such information puzzled the baby's mother. I learned that the guards at the National Museum, where he had an office, had their wives and sisters report to him. The imperturbable hero of George Horton's novel, "A Fair Brigand," is a good-humored caricature of the industrious secretary. Horton knew him perfectly fearless in danger. The story makes the American scholar marry the mountain maid who rescued him, and forget his bride on his wedding day, while he feverishly annotates the advance proofs of a rival antiquarian's inventory of the Acropolis bronzes. In reality, De Cou never forgot anyone or anything, unless it was himself. He might show a serene contempt for the omniscience of a fresh arrival in Hellas. But if that rival had come down with typhoid at Mesolonghi, after going there at a bad season against the secretary's advice, the secretary would have gone after him and nursed him through. Young women have made great fun to me of the care De Cou took of them when touring the Greek highlands with parties of students. Now the Mediterranean has taken him.

Waves in Solid Metal

AS illustrating the advances in metallurgy and engineering, it has been demonstrated that solid metals may reveal by their structure the vibrations to which they have been subjected.

In explaining this phenomenon, experiments have been shown proving that a beautiful wave structure can be imparted to the surface of mercury by the vibrations of a tuning fork, and that even the surface of solid lead which had been subjected to similar vibrations possesses a structure resembling that of a vibrating surface of mercury.

Mild steel has been defined as a "solid solution" of iron and carbon, free from cinders. Metallurgists have doubted the strength of steel as it was known in its early days.

Correspondence

A Night Rainbow

To the Editor of the SCIENTIFIC AMERICAN:

An unusual performance of nature was witnessed in Indianapolis, Ind., the night of April 4th. The day had been cloudy and was characterized by frequent showers. Heavy clouds still hung over the city when night settled. About 8 o'clock brought a slight break in the clouds. This was repeated between 11 and 12 o'clock. At about 11:30 there was a shower of short duration. During part of the time that the rain continued the moon was visible in the west—up 35 or 45 degrees.

The small light of the moon was hardly noticeable to one looking toward the east, but in the southeast a perfect rainbow developed. It perhaps would be well to qualify the statement that the bow was perfect, because it lacked part of the daylight rainbow—the colors.

The bow extended almost from due south to due east, was perfect in shape, and for a few seconds was quite brilliant. The appearance of the light was much the same as the shaft of light from a powerful searchlight, but was curved as is customary with the ordinary rainbow.

This peculiar demonstration followed closely upon another freak of nature. During a blinding snowstorm Sunday, April 2nd, the entire central portion of the State was treated to severe electrical disturbance. Lightning flashed frequently, the flashes being accompanied by heavy thunder. The bright lightning reflected on the falling and fallen snow was gruesome.

It may be that there is a connection between the electrical storm of Sunday, April 2nd, and the night rainbow of April 4th. If the bow had been in the north or northeast, it might be attributed to auroral conditions. JAMES HEDGE, JR.

Indianapolis, Ind.

[While there is nothing anomalous or mysterious about lunar rainbows, they are uncommon enough to be interesting.

The conditions necessary to produce a rainbow are (1) a brilliant source of light, of small angular diameter, behind the observer, and (2) a horizontal curtain of water drops in front of him. It matters not whether the luminous source be the sun, the moon, or, as in laboratory experiments, an artificial light. Even a reflection of the sun on the surface of a body of water may give rise to a rainbow, its position in the sky differing from that of the ordinary bow produced directly by the sun, whence we have the interesting phenomena of "intersecting" and "inverted" rainbows. (These and other more or less unusual forms of the rainbow are to be the subject of an illustrated article in a forthcoming number of the SCIENTIFIC AMERICAN.)

Returning to Mr. Hedge's observation, we find that he has correctly described the position of his rainbow, but he has overestimated the altitude of the moon. The bow was seen in the southeast—probably farther toward the south than a solar rainbow is ever seen—because on April 4th the moon was almost in its extreme northerly position with respect to the celestial equator. The center of a rainbow is always opposite the luminous source (in this case the moon); i. e., it lies in the straight line passing through the luminous source and the eye of the observer.

Now as the radius of the bow is about 42 degrees, it is evident that if the moon had been "up 35 or 45 degrees," the top of the bow would have extended hardly, if at all, above the horizon—unless the observer was standing upon a high hill or a mountain. Reference to astronomical tables shows that the moon was, in fact, some 14 degrees above the horizon at 11:30 P. M., local time, at Indianapolis (and of course still lower at 11:30 P. M. Central Standard Time).

Lunar rainbows are usually described as white or yellowish. There is, in fact, the same dispersion of color in the lunar as in the solar bow, but the former is immensely fainter than the latter, and hence the colors are rarely distinguishable. The apparent brightness of a lunar bow is the effect of contrast to the prevailing darkness of the sky; hence, like the stars, it can be seen only in the absence of daylight. Its small absolute brightness, compared with that of the solar bow, may be judged from the fact that the moon, even when full, is only about one-six-hundred-thousandth as bright as the sun.

On the night of April 4th the moon was about six days old. Its illuminating power was, therefore, relatively small, and this fact gives a unique interest to Mr. Hedge's observation. Lunar rainbows are rarely seen except about the time of full moon.

There could have been no conceivable connection between the rainbow of the 4th and the electrical storm of the 2nd, beyond the fact that both were episodes of a protracted period of cloudy and stormy weather, which, as is shown by the daily weather maps, prevailed over the Middle States early in April.—EDITOR.]

The Law of the Air

To the Editor of the SCIENTIFIC AMERICAN:

A recent correspondent of the SCIENTIFIC AMERICAN calls attention to the fact that Connecticut and California have been considering jurisdictional laws to control traffic by aircraft, and pleads for concerted action to determine a uniform code. Nations are as a general thing slow moving bodies, but in this instance a promising start has been made, although the United States is not taking its proper share in the work. The Comité Juridique International de l'Aviation, with which is associated a technical commission, was organized in Paris in the last days of 1909, and beginning with January, 1910, has been publishing *La Revue juridique internationale de la Locomotion aérienne* under the direction of an international committee. The American members of the committee are Arthur K. Kuhn of New York, Gov. Simeon E. Baldwin of Connecticut, and James Brown Scott of the Department of State.

From the outset the committee planned to establish a code of the air, and it began work with a prospectus, carefully drawn up, which after exhaustive scrutiny by capable jurists was approved. A beginning has been made in working out the legal problems, and several articles of the code have been decided upon. The method of study is for each national committee to consider a specified subject, and reach a decision as to the wording of the articles dealing with the matter. These reports are then studied in joint session and a final recension arrived at. The result is very workmanlike, and means to meet international needs.

Nationally the American Bar Association's Committee on Jurisprudence and Law Reform has before it a resolution of Gov. Baldwin's on federal control of aircraft, and a draft act on the subject was published by him in the *Michigan Law Review*, November, 1910. It provides for uniform registration.

Cambridge, Mass. DENYS P. MEYERS.

Ups and Downs of Acetylene

By Marius C. Krarup

ONLY the rapid development of the autogenous welding process, by which metal may be joined to metal without the use of any intervening solder or spelter and usually also without employment of flux, has saved the acetylene gas industry and the producers of calcium carbide from the courts of bankruptcy. For several years the steadily dropping prices for carbide threatened ruin to all who had gone into this production in Europe. A mutual agreement, by which the output was reduced to less than one-half of the capacity of the plants, stemmed the downward tendency somewhat and offered an example to the world of artificial throttling of competition, on an international scale, which could not well have been spared, since governmental interference with the self-imposed restrictions would inevitably have resulted in a considerable destruction of values. It seems characteristic of the advancement which has taken place in the understanding of co-operative methods that the carbide producers of Norway, Switzerland, Germany, England, France and Italy were able to reach a basis for agreement, although those whose production was least economical had to submit to much the hardest terms in the way of restricted output, while the production of the Norwegian works, for example, being favored with cheap water power, was reduced only from 80,000 tons capacity to 50,000 tons output. The mathematics of the world market were made the basis of the understanding, while those who held the key to the situation, by virtue of cheapest production and marketing facilities, did not insist on annihilating their less favored competitors. Now that the worst is over, thanks to the new demand for acetylene in the metal and steel-working industries, *Revue des Eclairages* devotes a hopeful article to this interesting situation. It says in substance:

"The progressive use of acetylene for illumination has after all been remarkable. The acetylene industry has in 1909-1910 shown its vitality by the manner in which it has progressed in all countries, despite the sharp crisis passed by the carbide factories. One must include in the view all that has taken place in the past fifteen years in order to realize the headway made in the new industry, not without fight and opposition from competing sources of illumination. Acetylene appeared, in fact, upon the industrial horizon at a moment when gas and electricity were in full flower. The Welsbach or incandescent mantle system had made coal gas a formidable competitor for electricity, and the latter, spite of its high cost, already enjoyed a vogue which has since only been accentuated. It was therefore difficult for a new illuminant to win even a modest place, but the tenacity of the promoters of acetylene (aided by the adventitious demand for a strong and windproof light for bicycle and automobile lamps) brought the new gas past the critical stage. The balance sheet of the industry already shows an imposing total. Calcium carbide is now an important product of electrochemistry. Nearly 250,000 tons is produced annually at 75 factories, and represents a value of 70 to 75 million francs. There are 500,000 stationary generators in use and millions of portable generators or lamps. In 900 little towns, counting from 1,000 to 10,000 inhabitants, this special illuminant provides the municipal light. Installations in the lighthouses of the coasts, in railway stations and coaches, in signal stations and in ships, are all proof of the vitality of the acetylene system. In all branches of industry, in agriculture, in the art of war, in medicine, in navigation, and indeed in all branches of the activities of civilization acetylene has rendered immense services. One can no longer deny that this gas is destined for a still greater future. A light source which is employed in all five parts of the world, from Europe to Oceanica, in the colonies, in the most remote and isolated islands and even toward the poles, cannot be the dangerous explosive on which too many people have chosen to throw discredit. Wherever acetylene has shone with its brilliant white luminance it has produced surprise, satisfaction and economy. Neither coal gas nor electricity can, like acetylene, be produced economically in any location and independently of the industrial conditions of the place."

Dwelling on the impetus which the acetylene industry is now receiving from the advancement of autogenous welding, which "bids fair to revolutionize metallurgy," the *Revue des Eclairages* also finds occasion to refer to a report of the United States Lighthouse Board which was quoted at the acetylene congress in Chicago in August, and according to which a kerosene burner of fifty candle-power costs the government 5,700 francs per year to maintain, by reason of the necessity of employing a light keeper and providing a habitation for the latter, while the same candle-power can be maintained for 75 francs per year by means of stored acetylene gas.

A Sound-proof Room

THE Physiological Institute of the University of Utrecht possesses one of the most remarkable rooms in the world, a chamber about seven and a half feet square, which is said to be absolutely noiseless, as far as the entrance of sounds from outside is concerned.

This room is situated on the top story of a laboratory building, and is an inside room, but so arranged that it can be ventilated and inundated with sunshine. The walls, floors and ceiling each consist of half a dozen layers of different substances, with air spaces and interstices filled with sound-deadening materials.

Some persons when in the room experience a peculiar sensation in the ears. While every effort has been made to exclude sounds that are not wanted, of course the object of constructing this singular room was to experiment with phenomena connected with sound. Some of the sounds employed are made in the room itself; others are introduced from outside by means of a copper tube, which is plugged with lead when not in use.

A New Potato

DURING the past two or three years remarkable progress has, it is said, been made in the cultivation of a new species of potato in the department of Vienne in France.

This potato originated in Uruguay, and is called the *Solanum Commersoni*. In its new environment in France, and by reason of its careful cultivation and selection, it has developed several forms that promise to become fixed, and to possess much value as additions to the food resources of Europe.

Among these forms, all springing from one parent species, there are a yellow variety, a white variety, a red variety, and a variety not specially characterized by color, all of which possess distinctive shapes and qualities. A fact that especially interests botanists and cultivators is that these varieties have evidently not yet reached their final settled forms, and the experiments in Vienne are closely watched because it is thought that they will throw light upon the unsettled question of the general origin of the potato.

The Eighth Motor Boat Meeting at Monaco

By the Paris Correspondent of the Scientific American

AFTER the numerous aeroplane flights that have taken place in France so far this year, it was a relief to the sportsmen of the world to gather at Monaco once more in order to witness the eighth annual motor boat races. After the phenomenal speed exhibited in the Solent by the new British boat "Maple Leaf III." a month or more ago, it was expected that extraordinary bursts of speed would be shown by the racers at Monaco; but in this, motor boating enthusiasts were disappointed, as there were but few racers, and as most of these broke down and failed to make any remarkable performances.

At the opening of the meet on April 3rd, several competitors went into the races without having their craft properly prepared. Moreover, the sea was rough, and as a result of this the "Pick-Ass VII." was overturned by a large wave and its owner, M. Rudolph Hertzog, and his two mechanics were obliged to climb up on the bottom of the boat until they were rescued and their craft was towed to a wharf.

The free-for-all race (one round of the 6.25-kilometer or 3.88-mile course) was participated in the first day by but one racer—the "Maple Leaf III.," which completed the course in 17 minutes, and also by the following cruisers in the third, fourth and fifth classes, viz.: Third class (26¼-foot hulls, having 4-cylinder motors of 100x106 millimeters—3.937x 3.960 inches—bore and stroke): 1, "Excelsior XIV.," 17:18 (13.45 miles per hour); 2, "Sultane," 16:59; 3, "Cesar," 31:21; 4, "Naval," 32:42.

Fourth class (26¼ to 39 1/3-foot hulls having 4-cylinder motors of 130 mm.—4.055 inches—bore): 1, "Lürssen-Daimler," 8:46 (26.56 miles per hour); 2, "Femina," 24:49; 3, "Elle," 27:27; 4, "Utile I.," 28:11.

Fifth class (39.37 to 59.05-foot hulls, having 4-cylinder motors of 155 millimeters—4.152 inches—bore): 1, "Chantecler I.," 10:13 (22.29 miles per hour); 2, "La Quise," 10:25. The racer "Ursula" of the Duke of Westminster broke one of her propeller shafts, and the propeller perforated the hull. Nevertheless, she was able to reach shore under her own power with the other propeller.

The second day the weather was much better, and the balance of the free-for-all race, i. e., for cruisers of the first and second classes, and for some of the other racers, was run off. The results were as follows: Cruisers of the first class: 1, "Hispano-Suiza," 10:50; 2, "Excelsior XV.," 13:01; 3, "Pas-si-fort"; 4, "Steno"; 5, "Simone"; 6, "Lella-Mériem." Second class: 1, "Gregoire IX.," 9:24; 2, "Gregoire X.," 9:45; 3, "Excelsior-Segnor"; 4, "Voltigeur"; 5, "Lisette"; 6, "Vedette du Cariad." Racers, first class: 1, "Labor V.," 7:47; 2, "Miranda," 7:54.

The final handicap, consisting of two rounds of the course, or a total of 7¾ miles, resulted as follows: 1, "Gregoire IX.," 18:04 (25.70 miles an hour); 2, "Hispano-Suiza," 20:22; 3, "Lürssen-Daimler," 14:46 (31.55 miles per hour); 4, "Excelsior XV.," 19:00; 5, "Chantecler," 17:33; 6, "Maple Leaf III.," 14:24 (32.36 miles per hour).

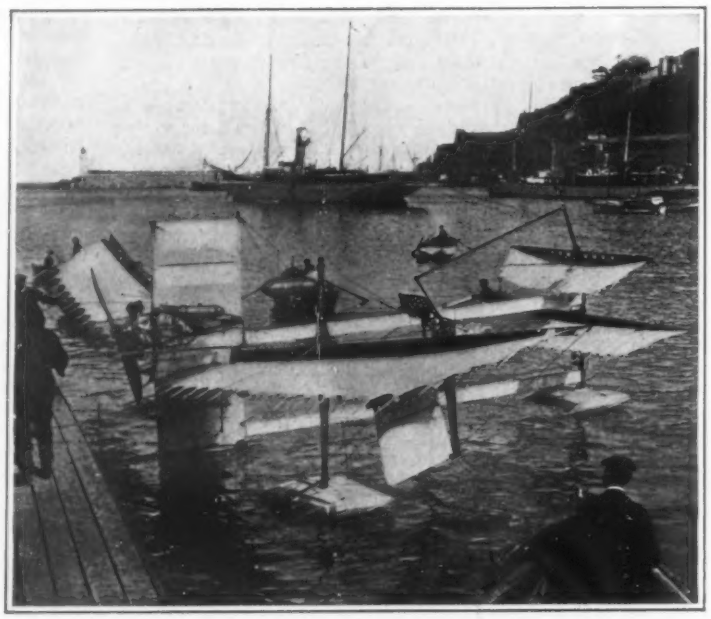
In the afternoon of the second day M. Bécue experimented with the Fabre hydro-aeroplane, frequently rising from the water and making evolutions in the air. The meet was delayed for a day on account of bad weather, but afterward the weather cleared and the 50-kilometer (31.06-mile) race for the $1,000 prize of the International Sporting Club was run upon a smooth sea. The results of this race were as follows: Racers of the first class: 1, "Hispano-Suiza," 1h. 42m. 19s.; 2, "Excelsior XV.," 2h. 20s.; 3, "Edelweiss"; 4, "Mistral"; 5, "Simone." There were nineteen entrants in this class. The racers of the second class finished as follows: 1, "Sigma-Labor," 1h. 13m. 40s. (25.30 miles per hour); 2, "Labor V.," 1h. 22m. 18s. "Miranda" and "Kangouroo" stopped on the fourth round and were not placed in the race.

The chief race of the entire meeting, the Championship of the Sea, was held on Sunday, April 9th, and no less than fifty-two boats were entered in this event for cruisers. The distance was 200 kilometers (124.2 miles). The race was won by the German boat, "Lürssen-Daimler," in 4 hours, 45 minutes, 17 seconds, which is equivalent to an average speed of 26.09 miles an hour. The prize was $1,200. The only other boats to finish the race were "La Quise," of M. Deperdussin (5 hours and 28 minutes), and the "Pick-Ass VII." (6 hours, 22 minutes, 28 seconds).

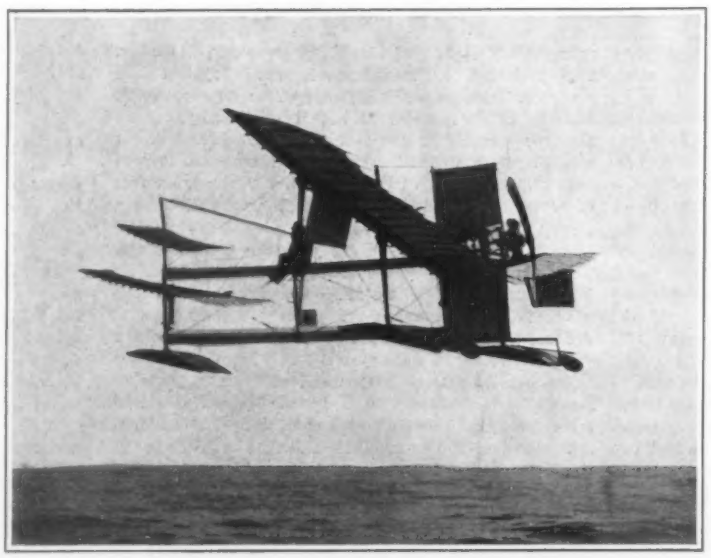
It was a noteworthy fact that all three of these boats were equipped with German motors, the winner having, of course, a Daimler engine, and the other two having Mercedes and Durkopp motors respectively. The "Lürssen-Daimler" had a flat-bottomed hull of the type used in the Prince Henry cup race. The "La Quise," built by the French constructor Pitre, had a similar hull, with a perfectly flat bottom, rounding upward a trifle toward the bow. Her motor was of less power than that of the winning boat, but she made good speed nevertheless, and the motor ran without a hitch for the 5½ hours. While M. Deperdussin was piloting his boat in this race, Vidart, on his Deperdussin monoplane, flew from Nice to the scene of the races at Monaco, and performed evolutions above the racers. This event is shown in one of our photographs.

On April 10th the "Prix du Tir aux Pigeons," the 50-kilometer race for cruisers, was run off, the winner being "Gregoire X." of M. Hinstin, which finished the race in 1 hour, 14 minutes, 36 seconds—an average speed of 24¾ miles an hour. In this race for cruisers, the superiority of the new Gregoire motor, which has a bore of 90 millimeters (3.543 inches) and a stroke of 300 millimeters (11.811 inches) was demonstrated.

The "Prix du Monaco" for racers of the second class was a walkover for the "Ursula," in 48:57. This craft had been repaired after her accident on the first day, and ran this race in good order. Unfortunately her only competitor, the "Clement-Despujols," was not in commission for this race. She was fitted with the 125 horse-power 4-cylinder motor formerly in the Clement-Bayard airship. This was mounted directly upon the hull of the boat, and the shocks and vibration of the hydroplane broke one of the lugs off the crank case, and made it necessary to



Side view of Fabre hydro-aeroplane at rest upon the water.



The Fabre hydro-aeroplane before—

And after she struck the rocks.

THE MONACO MOTOR BOAT RACES

have a new crank case before the boat could be put in commission again. One of our photographs shows this boat at full speed when viewed from the rear. She is a typical one-step hydroplane, and her hull has a peculiar curved shape as viewed from above.

The afternoon of April 11th a strong east wind arose, and it was only possible to run two races early in the afternoon. These were the "Prize of the Mediterranean" for cruisers of the third class, and the "Prix de la Cote d'Azur," for cruisers of the fourth class. The distances in both races were 50 kilometers.

The "Labor IV." won the first race in 1 hour, 4 minutes, 32 seconds (28.87 miles an hour). She beat by 8 minutes the time made last year in this race. This boat is a hydroplane with one step.

In the other race just mentioned, the "Lürssen-Daimler" finished first in 1 hour 3 minutes, in spite of an accident to the magneto, which was repaired during the course of the race. The hydroplane "Sigma-Labor" was running in second place, and was within half a mile of the finish when the pump chain broke and lost her the race. "Labor V.," however, obtained second place.

The chief remaining events were the "Coupe des Nations," on April 16th, and the "Coupe du Prince de Monaco," on the following day.

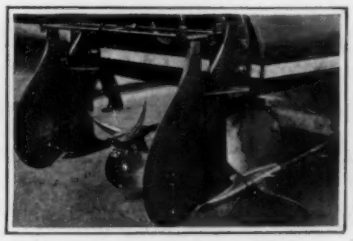
The first-mentioned race was run on April 16th, and was won by the "Lürssen-Daimler," her time being 2 hours, 1 minute, and 20 seconds, for the 62.1 miles. This is an average speed of 30.7 m. p. h. "Chantecler II." was second, with an average of 29.5 m. p. h., and "Hispano-Suiza" third, with an average of 24.4 m. p. h. "Maple Leaf" retired at the end of the first round. The "Clement-Despujols" and "La Fleche" were obliged to give up the race, as was also the case with "Ursula," owing to the asphyxiation of one of her crew on the ninth round. This happened on account of a leak in one of the exhaust pipe joints. "Lürssen-Daimler" broke her tiller rope near the end of the last round, but she had sufficient lead to enable her to restart and win the race after the tiller rope had been repaired.

Despite the fact that the British boats had undergone a continual run of breakdowns and ill luck, the "Ursula" finally succeeded in winning the "Coupe de Prince de Monaco" on the last day. This race was won in 2:34 1/5 over a course of 2,582 meters (about 1.54 knots).

The principal novelty at the meeting this year was the Fabre hydro-aeroplane, the "Goeland." This made a number of excellent flights, starting from and alighting upon the water with the greatest ease. On April 12th, while M. Fabre was flying her, he was obliged to descend quickly, as the wind was carrying him near to the ends of the piers. The front float struck on the crest of a heavy swell, and the machine tipped and struck its right wing against the rocks. It was badly damaged, as will be seen from one of the photographs.

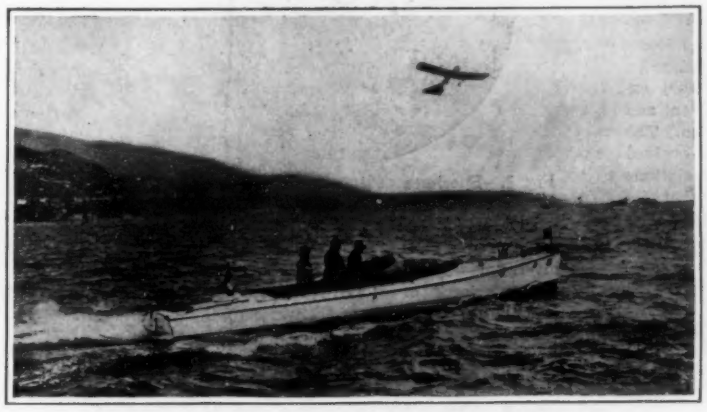
From the fact that the British racer "Ursula" made a round of the course in 5 minutes, 37 3/5 seconds, which is almost exactly 36 knots, and also on account of her having broken her record of last year (5 minutes, 20 4/5 seconds) by covering the course in 5 minutes, 13 3/5 seconds—a speed of well over 38 knots—it is supposed that the course was under the official figure of 6.25 kilometers in length. A complete circuit was not made in most instances when the boats were timed while racing, so that the records above given can probably only be taken as approximate. The longer the distance, however, the more nearly accurate the above records must be. It is probable that the experience obtained by the English with the racer "Maple Leaf III." will stand them in good stead when it comes to competing in the race for the Harmsworth cup, which will be held in Long Island Sound next August.

"Lürssen-Daimler" Racing.

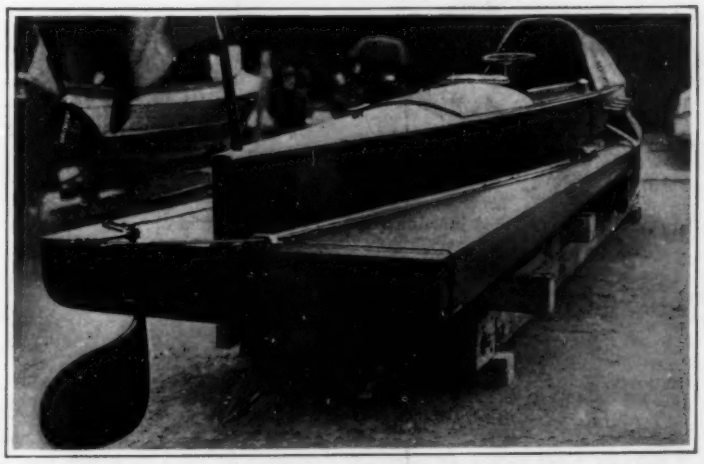


Stern of "Maple Leaf III."

"Lürssen-Daimler," winner of the "Championship of the Sea," viewed from the rear at full speed.



M. Deperdussin piloting "La Quise" while Vidert is flying a Deperdussin monoplane overhead.



"La Fleche," a step hydroplane built about a regular hull.

"Clement-Despujol" at full speed on the Seine.

THE MONACO MOTOR BOAT RACES

Possibilities of the Automobile

AUTOMOBILES have been utilized in various ways as auxiliary powers. The Editor of this journal once used his electric automobile to light a church. Farmers use the automobile to drive wood-sawing machines and churns. The increasing popularity of vacuum cleaners for domestic use and the necessity of a reliable power for maintaining the vacuum suggest the desirability of some inexpensive attachment or fitting for application to automobiles to adapt them to supply the power for operating the vacuum pumps. Possibly a simple pump might be incorporated in the automobile so that when the automobile owner stopped his machine in front of his home it could be utilized in connection with suitable air pipes and tools to vacuum clean the entire premises.

Counterfeit Coins and Baby's Bank

THE cashier of a prominent savings bank is responsible for the statement that a goodly sum of bad money annually finds its way into babies' banks. At first thought this would seem to indicate a mean spirit on the part of grown up folks to take advantage of innocent childhood, but the reason given by the cashier mentioned seems to set aside that impression. Many of the savings banks distribute small metal banks among their depositors. The keys to these are kept by the bank, and the money once dropped in the metal bank is accessible only to the parent institution. This is a very popular form of encouraging saving, and very few young couples who have a baby are without one of these little banks, conveniently placed to receive the spare coins which so quickly swell into large sums for the growing son—or daughter—and heir. These banks are brought to the receiving teller to be emptied and the contents credited to the depositor. That is the time when the teller has to watch out for counterfeit coins. It is seldom, indeed, that one of these metal banks does not contain at least one counterfeit coin. His theory is that lead nickels and quarters and dimes come to almost everybody in the course of time, and those who keep metal banks seem to have an idea that in counting out a large number of coins the teller is apt to overlook a counterfeit. Frequent resort, however, on the part of depositors to this way of making good the loss occasioned by the receipt of a bad coin has rendered the teller's eyes sharper and he looks more intently at the numerous coins dumped on his desk from the "baby's bank" than he does at the ordinary grist that comes to his mill. Of course a coin so discovered is courteously returned to the depositor, who generally murmurs something about "not noticing it was bad," and goes on his way, but the regularity with which such incidents occur has convinced cashiers and tellers that sooner or later all counterfeit money finds its way into some baby's bank.

The Current Supplement

THE current SUPPLEMENT, No. 1844, contains, among other striking articles, an authoritative explanation by a German naval officer of the accident that happened to the German submarine boat "U 3," on January 17th last, and the manner in which that unfortunate vessel was salved.—An artificial method of forcing basket willows is described.—Prof. August Weismann's splendid essay on Charles Darwin is continued.—Mr. A. D. Morehouse presents the second and concluding installment of his paper on "The Reclamation of the Southern Louisiana Wet Prairie Lands."—Mr. Robert Grimshaw presents a digest of the work prepared by the German Association of Steel Manufacturers on the subject of ceilings and girders.—A gravity surface for the handling of bricks is described by Mr. Frank C. Perkins.

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

The Application of Mathematics in Science

EVERY good and perfect gift is sure to be abused in the hands of some who lack either the skill to properly handle the tool placed in their hands, or the right spirit to appreciate its worth. There are those who bring discredit upon the value of mathematics in the service of science by their puerile endeavors perforce to turn to account in their work what facilities they possess in mathematical discipline, to force into the garb of a mathematical formula some irrelevant feature, some supposed numerical relation.

It is perhaps in part cases of this kind that Prof. Sedgwick-Minot had in mind when he said, in his address before the American Association:

"We biologists can not deplore too frequently or too emphatically the great mathematical delusion by which men often of very great, if limited, ability have been misled into becoming advocates of an erroneous conception of accuracy. The delusion is that no science is accurate until its results can be expressed mathematically. The error comes from the assumption that mathematics can express complex relations. Unfortunately, mathematics have a very limited scope and are based upon a few extremely rudimentary experiences, which we make as very little children, and of which probably no adult has any recollection. The fact that from this basis men of genius have evolved wonderful methods of dealing with numerical relations should not blind us to another fact, namely, that the observational basis of mathematics is, psychologically speaking, very minute compared with the observational basis of even a single minor branch of biology. Moreover, mathematics can at the utmost deal with only a very few factors, and cannot give any comprehensive expression of the complex relations with which the biologist has to deal. While, therefore, here and there the mathematical methods may aid us, we need a kind and degree of accuracy of which mathematics is absolutely incapable. For our accuracy it is necessary often to have a number of data in their correct mutual relations presented to our consciousness at the same time, and this we accomplish by the visual image, which is far more efficient for this service than any other means of which we dispose. When we wish to understand a group of complex related details, such as an anatomical structure, we must see them, and if we cannot see them no accurate conception of the group can be formed. With human minds constituted as they actually are, we cannot anticipate that there will ever be a mathematical expression for any organ or even a single cell, although formulæ will continue to be useful for dealing now and then with isolated details. Moreover, biologists have to do with variable relations, some of which of course can be put into mathematical form, but we find that even the simplest variations become clearer to us when presented graphically. The value to every student of science of the graphic method has been immense. Biologists can work to advantage with quantitative methods, we welcome the increasing use of measurements in biology, we welcome the English journal *Biometrika*, the organ of the measuring biologists—but none the less we refuse to accept the mathematical delusion that the goal of biology is to express its results in grammes, meters and seconds. Measurements furnish us with so-called "exact" records, but the aim of science goes beyond the accumulation of exact records to the attainment of accurate knowledge, and the accuracy of our knowledge depends chiefly on what we see. The practice of science conforms to this principle, the definite affirmation of which may prove of continuing advantage."

We cannot help feeling, however, much as we admire Prof. Sedgwick-Minot's forceful sayings and *bons mots* that his strictures on this matter are a little too severe. We call to mind a saying of the great English physicist, Sir J. J. Thomson. Referring to the feeling which seems to exist among certain men of science, who appear to hold it a virtue for a man to be "unmathematical," Sir Joseph points out that if this be indeed a virtue, it surely is of all virtues the easiest. We doubt if any but a mathematician of the highest order, a man like J. J. Thomson or Karl Pearson, is fully qualified to discuss the possibilities and limitations of mathematics as applied to the several branches of science. The dictates of common sense would seem to concur with the practice of the best authorities to the effect that wherever mathematics can be successfully and usefully applied, wherever a complete judgment of the question at issue is impossible without precise mathematical analysis, there is it indeed true, that "no science is accurate until its results can be expressed mathematically," and there mathematics must be applied regardless of any prejudice that may exist against the expression of results in "grammes, meters and seconds."

Pseudo-fabrics.

A FRENCH manufacturer of artificial silk has recently put on the market an apparently woven fabric, which is sold under the name of silk gauze. The material resembles other fabrics made of artificial silk in its brilliant luster and its lack of strength when wet, but careful examination with a magnifying glass shows that it is not composed of threads interlaced or woven together, but forms a continuous net of uniform thickness (Fig. 1), the fibers of which are fused or welded together at their junctions (Fig. 2). In short, it is not a woven fabric, but a pseudo-fabric.

Fig. 1.—Specimen of pseudo-fabric, magnified.

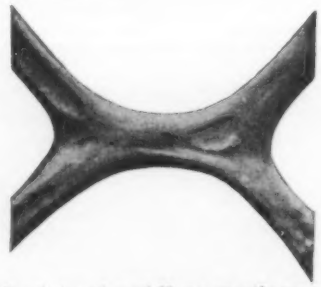


Fig. 2.—A junction of fibers, greatly magnified.

M. A. Chaplet, who describes this new material in a recent issue of *La Nature*, refers to previous articles describing various processes for the production of similar pseudo-fabrics which have been patented in recent years, but he adds that none of these methods has been found commercially practicable, and that the forms and inequalities of the elements of the new material prove that it is not made by any of these processes. Although the secret of the production is jealously guarded, M. Chaplet has succeeded in discovering the principle of its manufacture. The method is especially interesting because it differs widely from all methods already known and described.

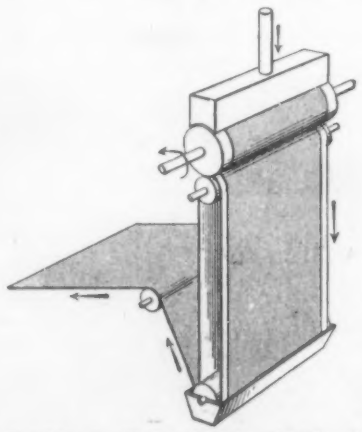


Fig. 3.—Diagram illustrating the principle of the method of producing pseudo-fabrics.

The continuous net which forms the gauze is molded upon a metal cylinder engraved with fine grooves arranged in a pattern similar to Fig. 1. This cylinder rotates in contact with a vessel filled with a solution of cellulose (Fig. 3), and the grooves are thus filled with the viscous solution, any excess of which is removed from the cylindrical surface between the grooves by suitably arranged rollers and scrapers. The cylinder is also pressed firmly along another element of its surface, against an endless carrying band to which the network of cellulose paste is thus transferred. This part of the operation is not accomplished without difficulty. In order to detach the soft tissue from the cylinder and transfer it to the carrier regularly and without tearing, it must be carefully started at the commencement of the rotation, and the viscosity of the mass, the character of the receiving surface and the temperature must be just right.

The endless band is stretched over a pair of rollers of which one is pressed against the casting cylinder and the other rotates in a trough which contains a coagulating bath (Fig. 3). In its passage through this bath the pseudo-fabric, already somewhat solidified by evaporation, but still very weak, is hardened and strengthened so that it can be detached from the carrier and drawn off to one side over a third roller (Fig. 3). It then passes through a hardening bath of formol, and through dyeing baths, if a colored fabric is desired, and is finally dried. The cellulose solutions, and the fixing, denitrating, fireproofing and other baths do not differ essentially from those employed usually in the manufacture of artificial silk.

The process is very ingenious, and its result is satisfactory, but its field of usefulness is very limited. In practice, gauzes and tulles are the only fabrics that can be successfully imitated by this method. An attempt to imitate the closely-woven silk fabrics that are most extensively used would result in the production of a continuous film or sheet of cellulose, having none of the peculiar characteristics of a woven fabric. Even if the closely-laid fibers could be kept separate, the impossibility of relative motion at their intersections, where they are welded together, would deprive the pseudo-fabric of the flexibility, extensibility and elasticity of a woven fabric.

Hence the industries of spinning and weaving are not threatened with extinction by this invention, but they may find a formidable competitor in another process, which is still in the experimental stage, and which is based on the spontaneous formation of thin fibrous felted tissues in solution of viscose in certain conditions.

In 1734, when the celebrated naturalist Réaumur predicted the manufacture of artificial silk, he also foresaw the production of pseudo-fabrics. The rapid development of the artificial silk industry gives reason to expect that pseudo-fabrics of real utility will soon be produced.

Cryptogamic Maladies of Cereals

THE steadily increasing public appreciation of the vital importance of the purity of food supplies makes especially timely an article on the deleterious effects of fungus growths upon cereals, recently contributed to *Cosmos*.

Thus the use of bread or flour made from ergotic rye causes a gangrenous or convulsive malady called ergotism, a disease formerly epidemic after very rainy seasons.

In Silesia and in Saxony in the sixteenth and the seventeenth centuries it was a fearful scourge, and at various periods since has been rife in other parts of Europe, owing to the carelessness or dishonesty of farmers in not separating the diseased from the sound grain.

Ergotic bread is slightly violet in color, unpleasant of odor, and bitter and unappetizing of taste.

When the ergot is sufficiently abundant it is revealed by the microscope. When present in very small amounts it may be detected by the following method:

Boil some of the flour in alcohol mixed with a few drops of hydrochloric acid and allow it to stand. The liquid will be of a red tint, more or less intense according to the amount of ergot present. One-half of one per cent may be determined by this process. From three to five per cent is sufficient to cause serious illness, which sometimes terminates in death. Animals also often fall victims to infected grain.

Cereals are subject to attack, not only by ergot, but

by other cryptogamic growth. Rust is caused by various kinds of microscopic fungi of the genus *Puccinia*. This malady, which was known to the Romans, appears as reddish pustules, finally becoming somewhat brown, which are found on the leaves and stalks of the grain as well as on the ears. This fungus grows at the expense of the plant, which is therefore defective. The grains shrivel and remain almost empty. The straw loses color and odor, and becomes injurious to animals. The empiric wisdom of the farmer has long accused the barberry of causing this affection, and as early as 1660 the Parliament at Rouen ordered the destruction of these shrubs throughout Normandy.

Modern botanical studies of the *Puccinia* have been found to justify this popular belief. If we examine a rusty leaf of the barberry we find at its base a sort of reversed cup bearing on the upper part of its bowl a membrane whence spring the rows of spores of the rust called occidium. If one of these spores be placed on a leaf of wheat or other cereal in the proper conditions of heat and humidity, it will soon germinate and a mycelium will develop in the plant. Soon after, microscopic rods which carry at their tops tiny yellowish rounded bodies, appear on the leaves, stalks, or ears. These give to the red rust of grain its characteristic aspect and secure its dissemination.

To sum up the matter briefly, the *Puccinia graminis* can not complete the cycle of its metamorphoses without two vegetable forms, the cereals and the barberries. Hence the suppression of the latter will stop the ravages of this plague.

Another *Puccinia* attacks wheat, oats, barley and rye, but its *occidium* develops only on the lycopodium or some other member of the family of *Boraginaceæ*. It passes through an identical vital cycle, but its orange colored spots form straight lines parallel to the veins of the leaves instead of developing without apparent order.

To combat rust, it is necessary to destroy both barberries and *Boraginaceæ*. Care must be taken to avoid an excess of nitrogenous fertilizers, which favor the increase of cryptogamous entophytes, and to cultivate varieties enjoying an immunity more or less complete from rust, such as hard wheat and St. Helen's wheat.

Wheat *caries* or rot, often wrongly confounded with smut, is likewise due to a fungus which invades the ovary of wheat, filling the grain with its spores, which form a black powder of fetid odor. This sometimes causes the loss of from one-half to three-quarters of the harvest. When the ears issue from the sheath they take on a bluish-green color and ripen before the others. The affected grain has a characteristic nauseous exhalation.

It is a member of the same family which produces smut, which develops like *caries*, but whose black spores are finer and odorless. This attacks chiefly barley and oats, and exerts its ravages on the parenchyma of the glumes. When the wind has blown abroad the powder of the spores, the ears are left mere blackened skeletons. Happily both *caries* and smut can be prevented by the sulphur treatment.

Another parasite, the *Ophiobolus graminis*, invades the joints of wheat stalks that are nearest to the earth. As the stalks are thus weakened the grain falls even in a very moderate storm. The best method of combating this trouble is sparse sowing to obtain vigorous plants and increased application of phosphates.

Finally we may consider the fight against ergot already referred to as the most serious disease of rye. This fungus, *Claviceps purpurea*, develops on the ovary, principally in wet seasons. The place of the grain is taken by an excrescence resembling the spur of a cock. Its mycelium is of a special form, enabling it to resist conditions unfavorable to vegetation. Falling on the ground during harvest or introduced by badly cleaned seed, it awaits the month of May to fructify, when it produces tiny rounded bodies at the end of a peduncle. From the whole surface exude small drops of a clear liquid in which swim the spores, which carried by insects to the flowers of the rye produce another form of the fungus.

The yellowish filaments of the mycelium gradually penetrate the walls of the ovary and take the place of the latter. To prevent the spread of this disastrous parasite, the first duty of the farmer should be to sift and sort the seed carefully. Then the rye should be cut before the flowering of the wild cereals in the vicinity in which the spores of the fungus might develop.

Hardware in the Stomach

FROM time to time there appear in the medical journals extraordinary catalogues of foreign bodies found, usually at necropsy and much less often at operation, within the stomach of an insane person. That such aggregations should be tolerated by the stomach for long periods of time is surprising enough, even when they consist of soft and yielding substances, such as the hair which becomes matted together to form a hair-ball; but when post-mortem examination of a person who has never shown the smallest sign of gastric discomfort discovers within the stomach a multitude of metallic objects, sharp, rigid, difficult to swallow and dangerous to retain, the only possible explanation of such an extraordinary insensitiveness must be found in the fact that the metal-swallower had been demented for years. The *London Lancet* records a truly remarkable instance of this insane propensity in the case of a mulatto woman, aged 33 years, admitted in 1903 to one of the Missouri State hospitals with acute mania, ending in dementia, and caused by excess in cocaine and morphia.

"From this time until September, 1910, when she died in the hospital, she never showed the least sign of disease of the digestive system. The attendants often saw her picking up nails and pins, but no one had seen her swallow any. Death was due to nephritis, and until a week before her death she never refused her food. Dr. A. H. Vandivert and Dr. H. P. Mills, who made the necropsy and reported the case in the *Journal of the American Medical Association*, were surprised to find the fundus of the stomach stretched down in a long pouch which reached into the left iliac fossa and adhered to the parietal peritoneum in that region. In this sac lay a hard mass which proved to consist of a large number of foreign bodies, leaving a narrow channel for the transmission of food along the lesser curvature. Adherent to the peritoneum of the stomach was the great omentum, remarkably thickened, and inclosing a number of small abscesses which represented the points at which the foreign bodies had made a way through the wall of the stomach, general peritoneal infection being averted only by the omental adhesion. The mucous membrane of the stomach was atrophic throughout, and ulcerated in patches; the submucosa was infiltrated with round cells, and the subserous connective tissue exhibited a general dense fibrosis. Ulcers and widespread erosion were also seen in the mucous membrane of the œsophagus. In addition to the foreign bodies in the stomach there was a needle in the œsophagus and another at the base of the left lung. The foreign bodies in the stomach weighed 2,268 grammes (5 pounds avoirdupois) in the aggregate, after thorough washing, and consisted of 453 nails, 42 screws, 136 ordinary pins, 115 hair-pins, 105 safety-pins, 52 carpet tacks, 63 buttons, and a miscellaneous collection of bolts, metal nuts, teaspoon handles, thimbles, needles, beads, coat-rack hooks, fruit seeds, stones and pieces of glass, and all sizes and shapes of similar objects, the total number being 1,446. The writers have arranged this scrap-heap in rosette form for purposes of photography, and have thus achieved an extraordinarily vivid picture of the possibilities of the human stomach."

Emotions and Morals

A PAPER read by Dr. William Brown at a recent meeting of the British Psychological Society is reported upon in *Nature*, from which we reproduce the following account. The subject of the discourse was "Emotions and Morals." After a brief survey of the views of earlier writers on the nature and classification of the emotions and their relation to ethics, in which, however, the doctrines of Aristotle and Adam Smith ("Theory of Moral Sentiments") were treated at some length, the speaker proceeded to discuss the meaning of the terms "passion," "emotion," and "sentiment" in relation to the theories of Ribot, Shand, and McDougall. According to ordinary uses of the term, and also to its etymology, passion would seem to indicate an uncontrollable state of mind, in the form either of an actual emotion or a system of emotional tendencies. Although Shand's employment of the term sentiment to express the conception of "a system of emotional dispositions centered about the idea of some object" would theoretically cover the latter of these two uses, passion seems to be a more appropriate and expressive word to indicate those systems which are uncontrollable by the rest of the mind, and issue, under appropriate conditions, in uncontrollable emotions, e. g., "a passion for politics," "a passion for the stage."

The word sentiment, as used in literature, has acquired associations of weakness or placidity which constitute a slight drawback to its use in scientific psychology to cover all cases included in the technical definition of Shand above mentioned. "Tender emotion," identified by Ribot and McDougall with the parental instinct, seems to have a wider connotation, and receives more adequate treatment from Shand. In particular, the element of tenderness or pathos present in many æsthetic emotions has little connection with the parental instinct.

The question of "emotions and art" was treated at some length, with special reference to music and the drama. Neither the sensationalistic nor the formalistic theory is adequate as an explanation of music. The ancient Greeks were right in regarding music as "the proper language of the emotions," but it is important to realize that the emotions of music are not, strictly speaking, identical with the emotions of everyday life. They are analogous to the latter, and this explains the appropriateness of the music to the words in opera, but they really belong to a world of their own and possess a meaning of their own. This is why the music of an opera, even when entirely appropriate to the words, may transcend them in such a way that elements of grossness in the story entirely lose their real "work-a-day" significance in the total presentation. The "Salome" of Strauss is a striking illustration of this.

As regards the psychology of acting, the important statistical investigation carried out by Mr. William Archer, the dramatic critic, more than twenty years ago, is the only work of definite scientific value hitherto produced. Mr. Archer's chief purpose was to test the paradoxical view of Diderot, accepted by Coquelin, but rejected by Sir Henry Irving, that stage emotion should not be real, and that the really first-class actor should be a man of little or no "sensibility." The results showed that in almost all cases of first-class acting in England, not only did the principal signs of real emotion—real tears, blushing, pallor, etc.—occur, but the artists experienced genuine emotion, and often found real emotion from their private lives help them on the stage by mingling with and intensifying their feigned emotion. A state of dual consciousness while acting was found to be common, but not universal.

Mr. Archer adds many further comments of considerable psychological value, and predicts that the subject will be taken up some day by trained psychologists and subjected to an exhaustive discussion.

As an illustration of many of the points raised by Mr. Archer, a letter very kindly written by Miss Ethel Irving as a reply to a query as to her state of mind when playing intense emotional parts, was quoted and discussed, and a general theory of stage emotion was sketched out and illustrated by a brief description of Miss Irving's recent emotional acting, especially in Henry Bataille's play, "Dame Nature."

Green Water of the Nile

THE "green water" of the Nile is quite a different thing from the green water of the ocean.

About April 15th the Nile begins its annual rise, and a month later the effect is felt at Khartum. A very curious phenomenon accompanies this increase, in the appearance of the "green water."

For a long time it was believed that the color came from the swamps of the upper Nile, lying isolated and stagnant under the tropical sun, and polluting the waters with decaying vegetable matter. With the spring rise this fetid water was supposed to be swept into the streams to make its appearance in Egypt.

Within recent times, however, this theory has been abandoned. Now, we are advised, the green water is caused by the presence of innumerable numbers of microscopic algæ, offensive to the taste and smell. They originate away up in the tributaries, and are carried to the Nile, where under the hot sun and in the clear water they increase with amazing rapidity, forming columns from two hundred and fifty miles to five hundred miles in length.

The weeds continue to grow, die, and decay until the turbid flood waters put them to an end, for they cannot exist except in clear water.

Offensive as, in some respects, the green water is, it is hailed with delight by the Egyptians, since its appearance is a sign of the real flood time and the close of the water famine.

Known by Their Sparks

EXPERIMENTS made in Budapest have shown that the spark rays made by the incandescent particles thrown off from iron and steel when put upon an emery wheel afford a means of testing the composition of the metals.

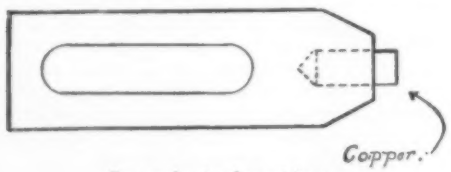
Carbon steels, manganese steel, and steels containing tungsten and nickel, each give a characteristic spark, of different forms and colors, which are easily distinguishable. The form of the spark picture changes with the quantity of carbon. Even so slight a difference as 0.01 per cent of carbon, it is said, can be detected in this manner. Pointed branching lines denote carbon steel; tool steel shows the appearance of "blossom" on the branches; tungsten steel gives red streaked rays and shining points, with little balls thrown out of the formation; and an explosion appearance in the articulation denotes the presence of molybdenum, vanadium or titanium.

ONE of the readers of Handy Man's Workshop wishes to know of a simple method of centering and reboring an engine cylinder in a lathe. Instead of replying to the question himself the Editor has decided to call for suggestions from other handy men.

Copper in Steady Rest Jaws

By H. D. Chapman

WHEN using the steady rest in lathe work, I have always had a lot of trouble because the jaws cut into and mar the work, especially brass work. I have tried hard wood jaws and other materials with little success, as they will wear away in a very short



Copper in steady rest jaws.

time, so finally I tried drilling a hole in the end of the jaws and used a round piece of copper. The piece was turned to fit neatly into the hole in the jaws. The copper was annealed so it would be soft. This little kink worked to perfection.

Planing a Cylinder Surface on a Lathe

By O. Ruehmer

A PLANER has many points in common with a lathe. For instance, the tool remains stationary while the work passes under it, and similarly in a lathe the tool remains in fixed position except when

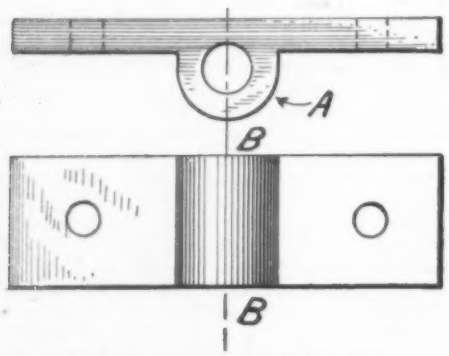


Fig. 1.—Casting to be finished all over.

moved to take a new cut, while the work revolves before it. The lathe, however, is more adaptable than the planer, and by keeping the work fixed and moving the tool with the usual feed mechanism, it is possible to plane a piece of work in the lathe. When thus employed its action is very similar to that of a shaper. The accompanying illustration shows an interesting bit of planing that might have been done on a shaper, though not so easily as with the lathe. The work consisted of a casting, plan and side views of which are shown in Fig. 1. This was to be planed all over, and

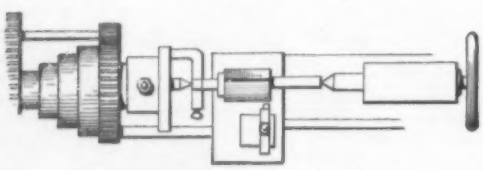


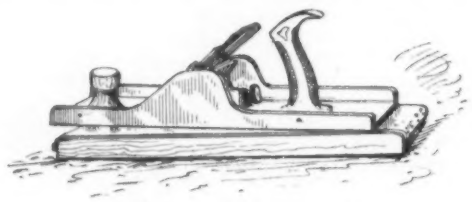
Fig. 2.—Using the lathe as a shaper.

the problem was to finish the cylindrical surface *A*. The casting was mounted upon a mandrel, the axis of which was made to coincide with the axis of the cylindrical surface. The mandrel was formed with a collar to take the thrust of the tool. The mandrel was then mounted in the lathe centers, as shown in Fig. 2. The back gears were thrown into mesh and the lathe head was locked. The tool rest and slide rest were then moved by hand, allowing the tool to take a light cut off the round part of the casting. By moving the head around slightly after each cut, the casting was turned to a perfect half cylinder in much less time than would have been taken had the work been done in a shaper.

Lubricating Iron Planes

By Albert F. Bishop

WHEN using an iron or iron-face plane the workman is apt to notice a disagreeable suction or repelling action which makes it necessary for him to use more force in handling the tool than when using



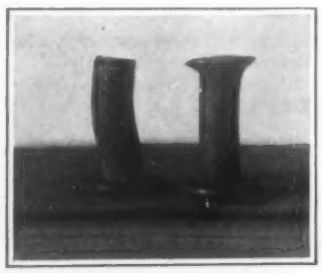
Iron plane on a lubricating tablet.

the wooden plane. Slight lubrication will make the plane work very easily, and the following may prove a useful suggestion in this connection: Take a piece of wood about a foot long and 3 or 4 inches wide by ¾ inch thick. Tack on two thicknesses of baize or a piece of thin felt. Draw the baize taut and secure it with tacks driven in the ends of the piece of wood so that they will be out of the way of the plane iron. Put a small quantity of oil on the baize or felt. In use, the baize will need a little oil from time to time. Now the workman simply lays his plane on the felt pad instead of on the bench; this will lubricate it sufficiently for the next planing.

Why a Light Hammer is Used in Riveting

By W. D. Graves

THE novice often wonders why a mechanic should tap, tap, tap with a light hammer, in pounding down the end of a rivet, when it appears to him that one or two blows with a heavier hammer would give the same result in much less time. The fact is that



Effect of light and heavy blows.

the heavy hammer would not at all effect the same result, as is shown by the accompanying photograph, which depicts two rivets, originally alike, both having been shortened to about the same extent by pounding on the ends. The one at the left was "upset" by a single blow of a heavy hammer, while the other was equally shortened by many blows of a lighter "riveting" hammer.

It will be noted that the heavy blow expanded the rivet quite uniformly for the whole length, while the lighter blows simply spread out the end of the other; the latter effect being the one desired in riveting. Of course, if the rivet had been rigidly held in a tight hole in solid material, even the heavy blow could have expanded only the projecting end; but rivets are not usually so held, and the tendency of the heavy blow, even in such case, would be to displace and force apart the pieces which it is desired to bring firmly together.

This photograph graphically illustrates the fact that, though different blows may aggregate the same amount of force, their net result is not always the same; and that judgment and skill may find exercise in the use of so simple a tool as the hammer.

Shop Notes

Reducing Friction When Threading Brass.—When cutting threads on brass rods or pipes, the dies have a tendency to howl or squeal. Very strong soap suds applied to the brass will reduce the squealing as well as the friction.

Bending Small Tubing.—For bending small brass tubing, take a close spiral spring that will make a neat sliding fit in the tube. The spring is annealed at the part that is to be bent. Then out of a piece of hard wood make a form about which the tube is to be bent. To remove the spring after bending the tube, twist the spring in the direction in which it was wound. This will serve to close the spring slightly so that it can be taken out easily. This little kink may be used on tubing up to ¾-inch diameter.

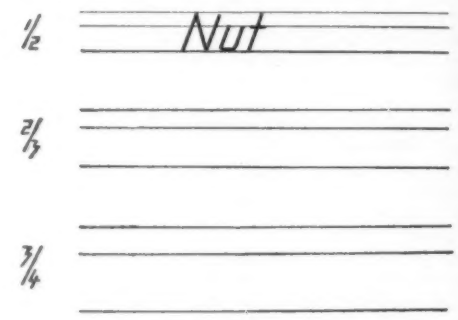
Oil for Oil Stones.—A splendid oil for oil stones is made by taking one part sperm oil and one part kerosene mixed, or if desired two parts kerosene may be used.

Removing Rosin.—In soldering work with soft solder, using rosin for flux to give a nice appearance, the melted rosin may be removed with a cloth moistened with benzole.

A Useful Device for Lettering Tracings

By Ralph C. Davison

FROM the tell-tale pencil marks which are seen on tracings, and which often show on blue prints, it is evident that many draftsmen do not know of the simple method of producing guide lines for letering their drawings. The illustration herewith shows a method which I have used for some time. It consists simply of lines drawn on a piece of Bristol-board

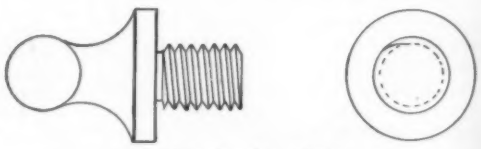


Guide for lettering tracings.

properly spaced for the size of the lettering to be made. Then instead of drawing pencil lines on the tracing cloth, as is usually done, this device is placed under the cloth, allowing the lines to show clearly through it. The lines then serve as a guide in lettering. I have found this device especially useful when working line drawings for reproduction, as by figuring out the proper sizes for ½, 2/3, ¾, and other reductions, one can always obtain the same uniform size of letter in his finished engraving.

Protecting the Threads of a Chuck

THE accompanying sketch shows how to keep the threads of a chuck clean. While the chuck is idle dirt will get into the threads, and if allowed to remain will cause the chuck to run out of true. Take

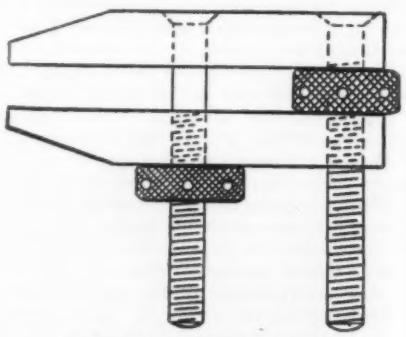


Wooden plug for a chuck.

a piece of hard wood and thread it so that it will fit the chuck. When the chuck is not in use the plug should be screwed in the chuck. This will keep the threads clean and there will be no trouble in getting the chuck to run true.

Handy Tool-makers' Clamp

THE drawing reproduced herewith shows a design of a tool-maker's clamp. It is frequently troublesome to get a clamp small enough for light work, such as small jigs, dies, etc. This clamp will take a



Handy tool-maker's clamp.

variety of sizes, yet it is small and will not take up much room in the tool kit.

The clamp is made of machine steel and is adjusted by the means of two thumb nuts. There are six holes drilled in the nuts for the use of a pin lever when the jaws are to be clamped tightly on the work.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Storage of Compressed Acetylene

EVER since illuminating gas came into general use, attempts have been made to compress it into portable steel cylinders or flasks for use on vehicles, and for country residences. The results obtained, however, were unsatisfactory, for illuminating gas is generally a mixture of many different gases, some of which easily liquefy under pressure while others, like methane, hydrogen, etc., can be liquefied only at very low temperatures. When these cylinders are connected up for use, the gas fed to the burner will vary greatly as to its heating and illuminating properties. Then there is always a certain part, generally as much as ten per cent, that will not volatilize but remains as a tarry deposit in the cylinder. Theoretically, acetylene is admirably adapted for this purpose, for it is homogeneous in its composition, leaves no deposit in the cylinder, and when properly fed to a suitable burner it gives an intense brilliant white light which is superior in many ways to any other form of illuminant.

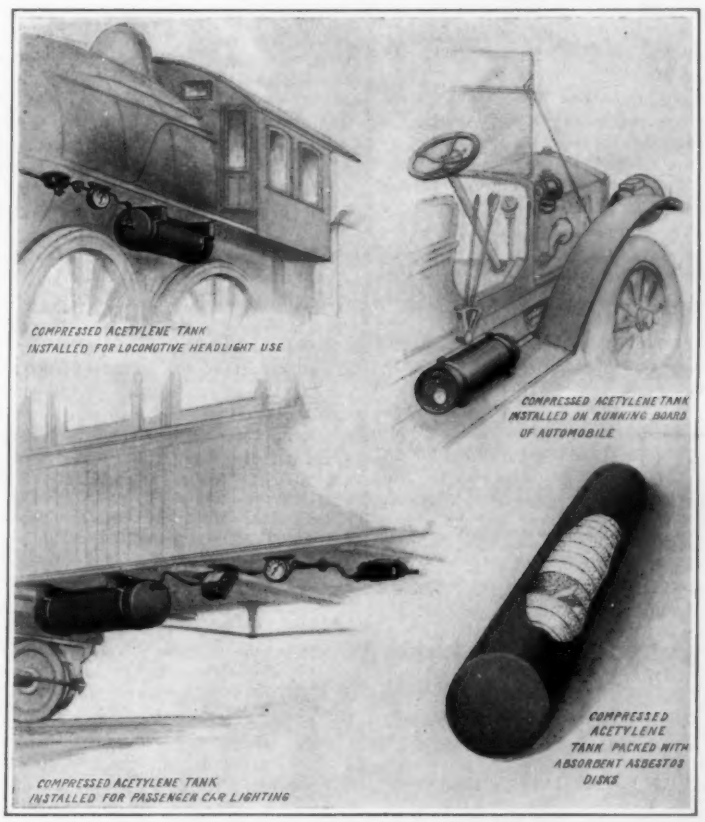
The introduction of acetylene for lighting and other industrial purposes, is of rather recent date. Prior to 1895, this gas was scarcely known outside chemical laboratories, but the discovery of calcium carbide and the process of making it, made this gas available for commercial use. Acetylene belongs to the class of unsaturated hydrocarbons and is unstable except at moderate pressures and temperatures. Its critical temperature is 37 deg. C., and pressure 68 atmospheres; however, it may be liquefied by a pressure of 21.53 atmospheres if the temperature is reduced to 0 degrees, and one cubic foot of this liquid would produce 400 cubic feet of gaseous acetylene at atmospheric pressure. If acetylene could be safely compressed and stored in steel cylinders in this cheap and simple manner, its use to-day would be much more general than it is, but liquid acetylene at normal temperatures is about as touchy as fulminate of mercury, and its disruptive power equal to that of nitroglycerine. Early attempts to handle acetylene in this form were fraught with numerous violent explosions. Usually it was impossible to discover the primary cause of the explosion, for the witnesses rarely ever survived the disaster, but it is probable that it was due to heat generated in manipulating the outlet valve or to some blow on the cylinder.

Acetylene under a pressure of less than two atmospheres or thirty pounds per square inch is practically safe against explosion. Should the gas be brought in contact with a wire at white heat or should a priming of fulminate of mercury be exploded in the cylinder of gas at this pressure, the gas in immediate contact with the wire of fulminate will be decomposed, but the explosion would not be transmitted to the whole mass. When under greater pressure, an explosion caused by heat or concussion at one point, is instantly transmitted through the whole mass, causing a violent explosion. If the gas is in the liquid form, the pressure generated is enormous, amounting to 5,000 or 6,000 atmospheres.

In exploding, acetylene disintegrates and hydrogen is set free and usually takes fire as it comes in contact with the air, while the carbon is thrown down in the form of an extremely fine impalpable powder. It is possible that carbon obtained in this manner, called "acetylene black" by Hubou, may yet replace lamp black for delicate work. It has a pure black cast or tint, is free from grease, and is specially suited for making black paint, printers' ink and for printing calico.

About 1897, Georges Claude, of liquid air fame, and another Frenchman, M. A. Hess, discovered that acetone, a combustible liquid resembling wood alcohol, would readily absorb acetylene gas. In putting this discovery in practical use, they partially filled the cylinder with acetone and then forced the gas in under a pressure of about twelve atmospheres. At this pressure and at ordinary temperature, the acetone will absorb about 300 times its own volume of the gas. When the valve is opened the pressure is reduced and the surplus gas passes off to the point of use, such as a burner, leaving the acetone unaltered and capable of taking up a fresh charge of gas. In all cases where acetone is used, the valve must be kept at the top to prevent its escape. No trouble, however, would result should it get mixed with the gas, since it itself is inflammable. The gas stored in this way is safe against explosion so long as the cylinder is full, but this process is open to one serious objection. Acetone increases in volume when it absorbs the gas. A cylinder having only forty-seven per cent of its volume filled with acetone at the beginning will be entirely filled with liquid when fully charged with the gas, and when the gas is escaping it shrinks, so that a cylinder which has been in use for some time will have a space at the top filled with gas under a dangerous pressure. Under a pressure of ten atmospheres (150 pounds) the presence of the acetone is an element of safety, for the acetylene dissolved therein does not explode, but should the pressure be over twenty atmospheres (300 pounds) it does explode and adds its heat of combustion to that evolved by the acetylene. While this process greatly reduced the chances of explosion, still the use of acetone alone was too dangerous to make the process a commercial success.

A few years later, Edmund Fouché, of Paris, added the final element which made compressed acetylene a commercial possibility. He first placed in the cylinder a filler of some inert porous substance, such as asbestos, infusorial earth, or charcoal, etc., and then added the acetone in which the gas was absorbed as before. In this way he prevented the existence of any considerable volume of compressed gas at any one point. In the illustration is shown one form of filler now in use. It consists of disks of asbestos entirely filling the cylinder. This filler decreases the gas holding capacity about twenty per cent, but its addition renders the gas entirely safe against explosion. In practice, these cylinders charged under ten atmospheres will hold about 100 volumes of the gas measured at atmospheric pressure. A platinum wire passing through the cylinder and heated electrically to a white heat has no other effect than to decompose the gas in immediate contact with it, for the porous filler effectually prevents the further spread of the explosive wave. The porous filler alone, when composed of charcoal, forms a perfectly safe medium for the storage of the compressed gas if the pressure does not exceed seven atmospheres. At this pressure, according to Capelle, a cylinder of one liter capacity will hold eight to nine liters of acetylene measured at atmospheric pressure. This is a cheap method and may be used advantageously where a large reserve supply is not needed. When the cylinders are exhausted they are usually sent to some central charging station. Here acetylene from the generator, after being purified, is compressed generally in two stages, carefully cooled and then forced into large storage tanks which also contain a porous filler and acetone. The exhausted cylinders are connected up and charged directly from these tanks.


COMPRESSED ACETYLENE TANK INSTALLED FOR LOCOMOTIVE HEADLIGHT USE
COMPRESSED ACETYLENE TANK INSTALLED ON RUNNING BOARD OF AUTOMOBILE
COMPRESSED ACETYLENE TANK PACKED WITH ABSORBENT ASBESTOS DISKS
COMPRESSED ACETYLENE TANK INSTALLED FOR PASSENGER CAR LIGHTING

The use of a cylinder with porous packing for storing acetylene under pressure.

The consumption of compressed acetylene has become enormous in recent years. Small portable generators are not practicable in winter, as the water is apt to freeze, but the solution of acetone and acetylene will not freeze during the coldest weather. To-day no automobile is considered complete without a cylinder of acetylene for lighting purposes. The cylinders are also extensively used in lighting railway cars, boats, buildings, and for oxy-acetylene flame apparatus. As yet they are used but to a limited extent on locomotives for supplying the head lights, but this field may widen in future, for the light produced by acetylene comes nearer to being the same as sunlight than any other forms of artificial illuminant, and hence does not distort or alter the colors of the various signals used in railway work.

The discoveries of Claude, and Hess, and Fouché were patented in this country, and as they dominate the only practicable process so far developed for storing compressed acetylene, they have been bitterly fought, but so far they have been sustained (see 166 Fed. R. 907). The courts have also decided that the recharging of an exhausted cylinder was an infringement of the patents (see 181 Fed. R. 387). These patents still have a number of years to run and constitute a valuable monopoly.

Resignation of Mr. Henry Blandy

HENRY BLANDY, one of the best known assistant examiners of the Patent Office, has just resigned, because of ill health. Mr. Blandy was in the Patent Office for a period of over forty years. He entered the Patent Office during the administration of Commissioner Leggett and was promoted eventually to first assistant examiner. His resignation takes effect on May 19th, 1911.

Mr. Blandy is a man of much refinement and culture, was devoted to his work in the Patent Office, and will be very much missed both by the Patent Office and the profession.

As an examiner in the class of musical instruments, of which he has had charge for many years, Mr. Blandy was pre-eminently "the right man in the right place." Gifted with a remarkable talent and love for music which were developed from earliest childhood, under the best instructors here and abroad, and possessed of retentive memory and great enthusiasm, he was useful in the treatment of the art during the great upbuilding of the past few years. At the time Mr. Blandy undertook the class of music, it was insignificant compared with what it is now. As time passed his long experience was added to his other qualifications so that for many years he has been doing what no other man could have done. Time after time, parts of the work were assigned to others, until practically his entire attention was given to the automatic or self-playing instruments, to which he has devoted his attention for the last few years. Some idea of the growth of the musical class of inventions may be had from considering one of the 250 subclasses of music, to wit, the keyboard players, pneumatic, which at the time Mr. Blandy undertook the class contained one United States patent and at the present time contains more than 200 patents. Of fifty-six sub-classes in automatic instruments, forty-three contained no United States patents and the others a mere handful. Many wholly new types of instruments have come into existence

during Mr. Blandy's long service, and others were so little known at its beginning as to have been practically nonexistent at such time. Among these are the autoharp, the keyboard mechanical piano player, so widely advertised now, the telharmonium and several types of electrical pianos which promise to endow the piano with practically the capacity of an organ for expression and sensitiveness of touch. Mr. Blandy has seen the successive great changes that have taken place during the last thirty years in response to the improved popular taste and the ability of the public to pay for better instruments.

The old instruments that the great masters have made immortal are still with us; but added to them are the pneumatic electrical organ and piano, an orchestrion and other equally wonderful instruments, while other still more magnificent ones will doubtless soon appear. Thus referring to Mr. Blandy in connection with his work seems almost like a historical review of the art in which he has lived his life thus far. He has grown with his work, has extended his acquaintance among the leading inventors of the art to which he has been devoted, and he will be greatly missed from his accustomed place.

The Congress of the International Union for the Protection of Industrial Property

THE appointment of delegates to the Congress of the International Union for the Protection of Industrial Property has been a slow process. The Commissioner of Patents, who is the chairman of the United States delegation, has been preparing a list of foreign delegates, adding to it from time to time as the nations make their announcements. Among the important nations who were adherents to the former treaties and conventions and who have not yet announced the names of their delegates are Germany, France, Austria-Hungary and Italy. The Italian government will not be represented at the Conference, owing to the fact that the International Expositions of Rome and Turin and the numerous congresses and conferences which will take place in the Kingdom of Italy this year on the occasion of the celebration of the fiftieth anniversary of national union, have absorbed the activity of many persons, who, on account of their technical and scientific competence, are a necessary help to the Royal Government in the preliminary work necessary to prepare for its participation in the Washington Conference. In addition to this reason, the Italian Royal Government, having presented to Parliament a project of law on industrial patents, a law which would radically modify on many points the law of 1859, now in force, could not begin international negotiations until the new *régime* in this matter is finally settled.

At Washington, however, it is hoped that Italy will designate some person to be in attendance at the deliberations of the Congress and represent that nation. Austria, Germany and France will appoint delegations very shortly, it is expected, the last two nations having already signified their acceptance of the invitation.

Commissioner Moore is now engaged in the preparation of the programme for the Congress, which is based, of course, upon the propositions submitted by the various nations. Most of these have already been received through the International Bureau at Berne, and M. Morel, the Director of the International Bureau, is now in Washington.

The delegation from Great Britain is composed of Mr. A. Mitchell Innes, Counsellor of the British Embassy at Washington; Sir Alfred Bateman, K. C. M. G., late Comptroller-General of the Commercial, Labor and Statistical Departments of the Board of Trade, and Mr. W. Temple Franks, Comptroller-General of Patents, Designs and Trade Marks. Mr. Innes has represented his government at Stockholm and at Buenos Aires at similar conferences. The delegation will be accompanied by Colonel Herbert Hughes, C. M. G., Law Clerk of the Sheffield Cutlers' Company, as expert adviser, and by Mr. A. J. Martin, of the British Patent Office, as secretary.

The delegation of Japan is composed of Morio Nakamatsu, Director of the Imperial Japanese Patent Office, and Mr. Keishiro Matsui, Counsellor of the Japanese Embassy at Washington. From Belgium will come a delegation composed of Octave Mavant, Chief of the Department of Industry; Georges de Ro, formerly attorney-at-law accredited to the Brussels Court of Appeals; Albert Capitane, attorney-at-law accredited to the Liege Court of Appeals, and J. Brunet, Director-General of the Department of Commerce and Consulates. Denmark will be represented by Count Moltke, Envoy Extraordinary and Minister Plenipotentiary at Washington; the Netherlands by F. W. J. G. Snijder van Wissenkerke, Doctor of Laws and Director of Industrial Property Bureau and Counsellor to the Ministry of Justice. Switzerland will send Dr. Paul Ritter, the Minister at Washington, who will be assisted by W. Kraft, assistant in the Bureau Fédéral de la Propriété Intelectuelle at Berne.

The other nations, adherent to former conventions, who have not yet appointed delegates are Brazil, Cuba, Spain, Mexico, Norway, Portugal, Sweden and the Protectorate of Tunis. In addition to the adherent nations members of the International Union, thirty nations were invited to send delegates and so become enrolled among the members of the Union. Of these, a very small number declined the invitation, and those who have named delegates are the Dominion of Canada, Costa Rica, Greece, Hayti, Panama, Paraguay, Persia, Russia, Siam, Salvador and Uruguay. Acceptances were received from Colombia, Ecuador, Guatemala, Honduras and Liberia, but no delegates have been named by these countries.

The Canadian delegation is composed of Sydney Fisher, Minister of Agriculture, who is also Commissioner of Patents, and George F. O'Halloran, the Deputy Minister of Agriculture. Russia has named Mr. Gregory Willenkin, financial *attaché* of the Embassy at Washington; Greece will send Lysmaque Caftandjoglou, Costa Rica will be represented by Senor Calvo, the Minister at Washington, and Panama will be represented by Mr. Belisario Porras, recently appointed Minister at Washington. Clifford Walton, Consul General of Paraguay at Washington, will bear the credentials of that nation, and Edward H. Loftus, First Secretary of the Legation at Washington, will represent Siam. In the absence of the Persian Minister from Washington, the *chargé d'affaires*, Mirza Ali Kuli Khan, will represent the Shah at the Conference, and Dr. Alfredo de Castro, First Secretary and *chargé d'affaires*, will be present on behalf of Uruguay. Salvador will send its Minister, Mr. Federico Mejia, and Hayti has named John Hurst and Edgard Numa, Jr., as its delegates.

There has been no intimation as yet as to the personnel of the French, German and Austrian delegations, but it is likely that the representatives of these nations will be chosen from members of the Diplomatic Corps now at the American capital. M. Morel, Director of the Bureau at Berne, will, upon his arrival at Washington, open a temporary headquarters for the transaction of the business of the Conference, and render such assistance to the American delegation as his ripe experience in these matters may suggest. Upon the chairman, Mr. Moore, devolves the arduous work of caring for the details of preparation and of disposing of the many questions as they arise.

Legal Notes

The Grant Rubber-tired Wheel Patent Held to Be Valid.—The Supreme Court has recently (April 10th, 1911) decided the case of Diamond Rubber Tire Co. vs. Consolidated Rubber Tire Co., holding the Grant patent No. 554,675 for a rubber tired wheel not anticipated, valid, and infringed. The patent sued on was not a broad one, the counsel saying of the claims, they are "limited closely to the specific construction of the Grant tire as it is actually shown and described in the patent."

The decision is of importance in indicating the Court's position in a case where the novelty is limited to the specific construction. The invention was in a highly developed art and, not the least influencing factor, the respondent exactly imitated the patented device instead of attempting to evade it. As to novelty and utility, the Court said, "It was certainly not an exact repetition of the prior art. It attained an end not attained by anything in the prior art and has been accepted as the termination of the struggle for a completely successful tire."

As to the right to protection of the limited invention, the Court says, "In its narrow and humble form, it may not excite our wonder as may the broader or pretentious form, but it has as firm a right to protection."

In treating the exact imitation of the patented device in view of the contention that the prior art was crowded with numerous prototypes and predecessors of the Grant tire, the Court very aptly says: "It gives the tribute of its praise to the prior art; it gives the Grant tire the tribute of its imitation as others have done. And yet the narrowness of the claim seemed to make legal evasion easy."

It appears that the apparent narrow scope of the patent coupled with the necessity of closely imitating the patented structure in order to secure the desired result, actuated the Court of last resort in holding the patent valid and infringed.

The Patent Monopoly Legally Considered.—The recent decision by the Supreme Court in the Dr. Miles Medicine Co. case may be regarded as bearing more or less on patented inventions because it seeks to distinguish between control by virtue of patent grants and control by way of contract in cases where the statutory monopoly is not involved. The question of control by the owner of a patent has of course been the subject of much litigation, and it arises directly and indirectly, the latter more frequently because of repairs to patented machines. An early case of patent control after purchase is that of the bale tie in which a patent was granted covering the buckle and band, and the tie as sold was marked "Licensed to use once only." The parties sued purchased the used bands and buckles as scrap iron, straightened them out and connected them, in cases where they had been cut, and sold the ties to be used. The Court held this an infringement of the patent. On the other hand, there are cases which appear to lean to the view that where the device or machine covered by the patent has by sale and purchase been taken out of the monopoly, the patentee is without right to restrict its use for his benefit, the machine becoming the property of the purchaser to be used or sold or disposed of as he pleases, so that he may repair it to any extent he pleases so long as the identity of the original machine is not destroyed. If, however, the machine is worn out or practically destroyed, the owner cannot rebuild substantially a new machine since the rebuilt machine would be an infringement of the patentee's monopoly. In one case it was held that if a part was so broken or worn as to require replacement it could not be repaired without the consent of the patentee; but repairs by means which merely kept the article up to the work for which it was designed were permissible. As in most controversies, each case must be considered in the light of its own facts and circumstances, and it appears difficult to lay down any positive rule governing the patentee's control after a sale outright of the patented invention.

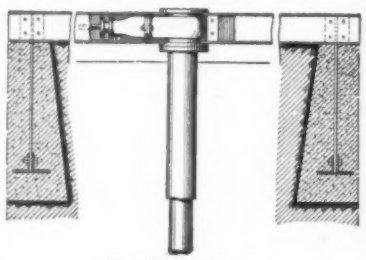
RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of General Interest.

PROCESS FOR REMOVING INK OR COLORING MATTER FROM PAPER.—W. B. MEIXELL, Sayre, Pa. This improvement pertains to a process for removing ink, coloring matter or pigment from paper. The main object is to provide an exceedingly simple process for taking out ink from printed papers, such as old newspapers, book paper, etc., without harming the fiber, so that the latter can be repulped and made again into white paper.

OIL-WELL CONTROL.—JAMES E. SUITS and ROBERT B. ARMSTRONG, Douglas, Ariz. Among the principal objects which the invention has in view are: To provide means for checking and controlling the flow of oil, water or gas from a deep bored well, and to



OIL WELL CONTROL.

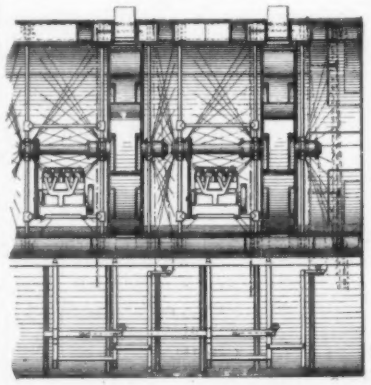
provide an emergency flow checking device to control the rush of liquid from the well during or at the completion of the bore itself and prior to the installation of the controlling head therefor. The employment of the invention illustrated herewith is called into use only when and as a gusher is opened and when the same is ascertained by the drive or spurt of the oil or water, as the case may be, to be past the control rods and through the head of the boring tools.

Household Utilities.

FOLDABLE BED SPRING.—W. THOMPSON, New York, N. Y. The aim of this invention is the provision of a spring made in sections, capable of folding one on top of the other to permit convenient cleaning underneath the bed, and to take up very little room when folded for shipping or storing purposes or for carrying it about, especially along narrow halls, through doorways, etc.

Machines and Mechanical Devices.

AIRSHIP.—JOHN W. WADSWORTH, Leetsdale, Pa. The invention illustrated by the engraving relates particularly to the heavier-than-air type of air ship. The object is to produce an air ship which will have a high degree of buoyancy and dirigibility. In its



AIR SHIP.

general construction it comprises a body in which a plurality of rotatable wheels are mounted. In rotating, these wheels draw in air, and the latter is guided in suitable ducts to different points of the body of the ship from which it will be discharged. The direction of advance of the ship is controlled by controlling the flow of the air in the ducts referred to.

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(12446) X objects to the statement in a recent article that gravitation was a tremendous force, and quotes a statement from some book that a pair of bullets would require a very long time to come together, if hung only a centimeter apart, by their own attraction alone. A. The force between small balls is small because it is a law that the force is proportional to the product of the attracting masses. It follows when the masses are great that the force is great. A paragraph has just appeared in *Science* [see *Science*, March 10th, 1911, article by Charles F. Brush, "The Kinetic Theory of Gravitation"] on this point, which we quote: "When the bodies are of planetary size, the aggregate attraction of their molecules is enormous. It is easy to calculate that the attraction between the earth and the moon, which is just sufficient to retain the latter in its orbit, would, if replaced by a steel cable, require that the cable be about five hundred miles in diameter. Between the earth and the sun, the cable would have to be nearly as large as the earth; and attraction between the components of some double stars is millions of times greater than between the earth and the sun. (Lodge.) So tremendous a phenomenon as gravitation, a phenomenon compared with which all others seem trivial, must have a mighty origin." We need add no words of our own in defense of our statement. We would say in addition that the force of gravitation is the same in degree between two motes in the sunbeam as between two stars in space, since it is proportionate to the quantity of matter which the attracting bodies contain. Moreover, the gravitating force of the earth will give a velocity of over a mile a minute to a mote or a drop of water in a vacuum at its surface in the short space of three seconds. We have never seen nor heard of an electric motor which could produce an acceleration of 32 feet per second. This is more striking than the other statement that two bullets would require years to come together from a distance of a little over a half inch by their relative attractions.

(12447) C. J. W. asks: What is the usual voltage in the secondaries of an igniting system for explosive motors? A. It is commonly estimated that a voltage of about 5,000 is required to force a spark between points in air a quarter of an inch apart. For a half inch about twice as much is required. These are the results of experiment with high potentials.

(12448) J. L. asks: 1. What is the best material for lightning rods? A. Some of the best authorities say that iron is the best material for lightning rods, and others think that copper is the better. Where the doctors differ who shall decide? Probably either is good enough. Certainly the older belief that the rod with the lowest electrical resistance is the best has been abandoned. 2. What is a diamagnet? A. A diamagnetic substance is one which places itself across the lines of a magnetic field, so that its longest axis is east and west if the lines of magnetic force run north and south. A magnetic substance places itself lengthwise of lines of force, so that it stands north and south on the earth, as a magnet does. Bismuth is a diamagnetic substance. 3. What is ether? A. There are many kinds of ether known to chemists. The best known one is the ether used to produce unconsciousness in surgical operations. This is called sulphuric ether. It is made by treating common alcohol with sulphuric acid and distilling. Perhaps your question refers to the ether of space, which scientists believe fills all space and through which all energies are transmitted. The necessity for a medium to transmit energy from the sun to the earth led to the hypothesis of the ether. This hypothesis has been strengthened as new discoveries have been found to be in accord with it, and now the belief that such a substance exists is well nigh universal.

(12449) J. P. says: What is the meaning of the word *watt* in connection with electricity? A. A *watt* is the unit of power in an electric motor, of which 746 make a horsepower. 2. What does one *horse-power* constitute as applied to engines? A. A horse-power is the power required to lift 550 pounds one foot in one second. This is the same as lifting a ton of 2,000 pounds one rod in one minute. It is more work than most horses can do. It was determined by Watt at the collieries in Wales long ago, when horses did all the work of the engine, in the days before the steam engine was invented. These powerful horses perhaps did this amount of work.

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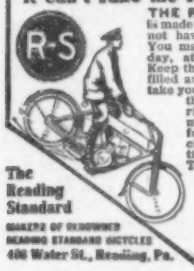

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Heat from Dust

(*Continued from page 444.*)

no smoke in burning, and therefore large amounts of it are now being removed from the banks, where it has been stored for years, subjected to a washing process if necessary and shipped to the larger cities of New York State and New England, where it is sold as a fuel for heating office buildings and producing power in plants located in cities having strict smoke laws. New York city is the largest user of this culm.

This anthracite culm makes excellent briquets and gas-producer fuel, as will be shown presently.

Coke Breeze. Coke breeze is a by-product of the coke or gas industries. In the preparation of illuminating gas, the coke resulting from the distillation of the coal when removed from retorts is in the form of large and small pieces and dust. This dust and smaller sizes are called coke breeze.

In the manufacture of coke, both by the bee hive oven and by-product methods, coke breeze is also obtained in large quantities. Methods of utilizing it are described further on in this article.

Sawdust and Wood Waste. One of the most wasteful of our industries is the wood industry. Mr. George B. Frankforter states in a recent article on "Wood Waste and Its Utilization" that the best that model mills can do at the present time in the logging and milling part of the industry is to save a scant 40 per cent of the total weight of the wood in lumber, laths and shingles. Fifteen years ago the average was probably only 30 per cent. The average, now, is about 35 per cent lumber and 65 per cent waste. This waste includes stumps, tops, slabs, and sawdust. From 5 to 15 per cent of the logs sawed go into slabs. About 20 per cent of the log goes into sawdust. The most economical lumber mills in the country, at Marshfield, Oregon, saw on an average 100,000,000 feet of lumber in a year, or approximately 150,000 tons of lumber. On the basis of 65 per cent waste, this one mill alone produces annually 225,000 tons of wood waste, and this waste is burned either on the ground where the trees were cut or in waste burning furnaces at the mill. If one mill, and that the most economical, produces annually 225,000 tons of waste, then the total loss for all the mills in this country must be enormous.

This wood waste can be utilized in several ways, some of which will be mentioned.

Lignite. Lignite is a variety of fuel between peat and bituminous coal in quality. One form of lignite is called brown coal in Germany from its characteristic color. In this country it is the custom to speak of two kinds of lignite, viz.; lignite and black lignite.

There are immense deposits of lignite coal in the western and southern States, the most important deposits being found in Texas, North Dakota, Colorado, Montana and California. These deposits vary in thickness from a few inches to over thirty feet. This fuel contains a high percentage of water, American lignites having as high as 42 per cent of moisture in them when fresh from the mine. This high moisture content decreases the heat value of the fuel, and as it is non-caking, special furnaces are required to burn the raw lignite properly. Lignite cannot be stored in the open in large piles on account of the slackening down that takes place when it is exposed to the weather for only a few weeks. Spontaneous combustion also occurs more easily in piles of this fuel than with bituminous coal.

Peat. Peat is the lowest grade of fuel recognized in the classifications of fuels. It is the partially decomposed remains of moss, and other similar plants, which are found in wet marshy places. Its high moisture content (sometimes as high as 85 per cent) has prevented its extensive use as a fuel, as all attempts to dry it artificially on a large scale have not been profitable, as the cost of handling large amounts of raw material and supplying heat to dry it is prohibitive.

Numerous experiments in this country to utilize peat for fuel have not met with much success up to the present time, but possibly in a few years the high price of other fuel will lead to further development of peat for fuel in districts near the peat beds.

Methods of Utilizing Fuel Waste. There are two general methods of utilizing the fuel material described above.

1. The gas-producer to convert it into commercial power.

2. The briquetting process to convert it into a domestic fuel.

Gas-Producer. The gas-producer has been brought up to such a state of perfection that it is without doubt the most efficient means of obtaining power from the poorer grades of fuel. To those who are not familiar with the principles of the gas-producer it may be well to explain that a gas-producer is an apparatus for burning a thick bed of fuel into which air is blown. Steam is also sometimes introduced with the air. Combustion of the fuel in the lower part of the apparatus forms carbon dioxide, and this is partially reduced to carbon monoxide in passing through the incandescent fuel in the upper part of the bed. The steam is broken up into hydrogen and oxygen. The hydrogen and carbon monoxide are combustible gases and diluted by nitrogen and some carbon dioxide they form producer-gas which has comparatively low heat value.

This producer-gas when used in a gas engine produces power at a much greater efficiency than is obtained by the steam boiler and steam engine.

In those European countries where the supply of high grade fuel is limited, gas-producers are extensively used as a means of generating gas for power purposes from lignite and waste fuel materials. In the interior of Mexico, where coal is scarce, mining companies use a scrub growth of wood for gas-producer fuel with satisfactory results.

As industries develop in those parts of the West and South where vast deposits of lignite are to be found, we may look for a rapid increase in the number of producer-gas plants using lignite fuel to supply the power required, and as these parts of the country become more thickly populated by people engaged in agriculture as well as in industrial pursuits, there will be a demand for lignite briquets for domestic fuel.

Bituminous slack, anthracite culm, wood waste, lignite and even peat, if the latter is partially dried, can be used with excellent efficiency in the gas-producer. Coke breeze also gives good results as a gas-producer fuel. Lignite even in the raw state furnishes an excellent producer-gas even better in heat value than the gas produced from the best grades of bituminous coal. This improvement is due in large measure to decomposition of the large amount of moisture found in the lignite into hydrogen and oxygen. Peat is a good gas-producer fuel if air dried before use so that it contains less than 40 per cent of moisture.

Briquetted Fuel. The process of briquetting fuel, although not very well known in this country, is perhaps the best method of converting a low grade fuel into one of higher value and of utilizing the waste from mining high grade fuel. The briquetting process is a method of converting loose pulverulent material into solid blocks called briquets. This briquetting process has been successfully used by European countries for the last thirty years.

In the year 1908 the world production of briquetted fuel was 28,600,000 short tons of which Germany produced 20,900,000 short tons, or 73 per cent of the total. In the same year the United States produced only 90,358 short tons valued at the plant at $323,057, or an average price of about $3.50 per ton. In 1909 the United States produced 139,661 short tons, an increase of 54 per cent in quantity and valued at $452,697, or $3.25 per ton, so that it is evident the industry is making substantial progress in the United States. There were sixteen plants in this country which produced fuel briquets in 1909, and while some of these plants were only experimental, about one-third of them are built on a practical basis and are apparently meeting with success.

When the public is once familiar with the advantages of briquetted fuel, it is safe to say that there will be no difficulty in selling all that can be made at a profit of not less than one dollar a ton. If sacked and peddled at retail $6 to $8 per

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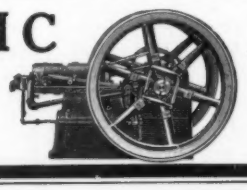

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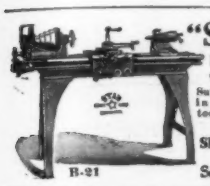

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ton may be realized, but of course this would be an exceptional case.

The general method of briquetting a fuel is to mix the powdered material with from 5 to 11 per cent of pitch from coal tar, water gas tar, asphalt tar or similar substances and heat the mixture until the binder is softened, after which the plastic mass is pressed in suitable presses into briquets of the desired shape.

Briquets can be made from bituminous slack, anthracite culm, wood waste, lignite and peat. Some grades of lignite do not even require the addition of binding material. Briquets are superior to the fuel from which they were made because the uniform size of briquets permits better combustion and efficiency; they withstand the effects of weathering longer; if properly made they burn with less smoke; they are cleaner to handle; there is less loss by breakage in transportation and the danger of spontaneous combustion is eliminated when fuel is stored in briquetted form.

Briquetted fuel is now on sale in New York city and vicinity; Detroit, Michigan; Kansas City, Missouri; Indianapolis, Indiana; St. Louis, Missouri; Superior, Wisconsin, and other cities.

Coke breeze, although of good fuel value, has been to a large extent wasted and many attempts have been made to briquet it, but up to the present time with small success, owing to the abrasive action of the breeze which acts very much like carborundum and wears the dies and working parts of the machinery quickly. Attempts to briquet it are being continued, however, and it is to be hoped that ultimately this can be successfully done.

Bituminous slack and anthracite culm can be made into excellent briquets and practically all of the fuel briquetting plants of the country are at the present time using one of these two fuels.

Sawdust is briquetted by several firms in Europe for a household fuel. Sawdust briquets, while almost as easily ignited as wood, burn much more slowly owing to their having been compressed so highly in the making. This is an advantage as the fire does not need replenishing so often.

As stated above, some varieties of lignite can be briquetted without the addition of binding material. To do this, however, a very high pressure is required. Those lignites which require binder to briquet them can nevertheless be made into good briquets which will stand the weather better than those made without binder.

In Germany, brown coal briquets have been used for the last thirty years as a household fuel, and in the year 1908 15,700,000 short tons of these brown coal briquets were produced in that country. North Dakota is now carrying on investigations looking to the utilization of the lignite deposits within the borders of that State.

Peat cannot be profitably briquetted by the same method used for coals and lignite, but considerable success has been met with in converting peat into fuel by "machining" or macerating the raw peat and squeezing the wet mass through the gradually narrowing orifice of a so-called "auger machine," cutting the peat into suitable lengths and then stacking these pieces to dry in the open air or in low sheds with roofs but no sides. In parts of Germany and Sweden the manufacture of these "wet pressed" briquets has attained considerable importance.

Since 1904 the United States government has carried on extensive investigations of the steaming, briqueting, gas-producer, coking, and other qualities of the fuels of this country and the results of these valuable investigations have been published in bulletins of the United States Geological Survey and the Bureau of Mines. These bulletins may be obtained without charge by application to the director of the Bureau of Mines, Washington, D. C.

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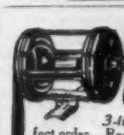

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The Aeronautical Society Banquet.—The first annual banquet of the Aeronautical Society occurred at the Hotel Astor, New York city, on the evening of April 27th. Although the society is more than three years old and has nearly 400 members, it has never held a banquet before. The president of the society, Mr. Hudson Maxim, presided and made an elaborate speech in presenting to Wm. R. Hearst the Society's annual medal for the most laudable act in furthering the cause of aviation.

The $50,000 Transcontinental Aeroplane Prize.—Mr. Hearst responded and said he hoped his $50,000 prize for a transcontinental flight, which is up for competition until next October, would be the means of developing an aeroplane suitable for extreme long distance cross-country work. As for the war aeroplane, he did not think this would have an extended use, chiefly because there would be no wars. But for purposes of peace and commerce he believed the heavier-than-air machine would be widely used. He welcomed the interest now being taken in its development by our government, as he recognized that an aeroplane that would carry a cannon could just as well be used to carry a board of trade or a bale of merchandise.

Attitude of Our War Department Toward Aviation.—Brigadier General James Allen, chief of the Signal Corps, told of what the War Department is trying to accomplish with its $125,000 appropriation. He said the Signal Corps wants aeroplanes capable of carrying a load of 400 pounds in excess of the aviator, fuel, etc., and of flying as far and as fast as possible when fully loaded. That the War Department will pay good prices for machines that fulfill the requirements is shown by the purchase last week of new Wright and Curtiss biplanes at $5,000 and $6,000, respectively. The new government aviation field at College Park, Md., is open for the use of aviators, and permission to fly at government posts such as West Point, Governor's Island, and the like, can readily be obtained. General Allen hoped that the amateur aviators of the country could be called on in time of need, and he made it plain that the government expects to help them in practical experimentation whenever possible. The theoretical side of aviation will be taken up in a laboratory at Washington.

Langley and His Part in Aviation.—Dr. Charles D. Wolcott, secretary of the Smithsonian Institution, spoke on "Government Interest in Aeronautics." After telling of Prof. Langley's experiments and his production of a steam driven model that flew half a mile above the Potomac River in 1896, Dr. Wolcott explained how our government came to the aid of his renowned predecessor and enabled him to build a man-carrying machine. As is well known, this following-plane biplane was never successfully launched.

President Taft on Aviation.—The arrival of the Hon. William Howard Taft was the cause of great cheering. The President spoke reminiscently of the progress of invention as noted by him years ago when he was a lawyer and a judge and came into intimate contact with inventors and their work. In closing he said that he was ready to go up whenever an aeroplane was produced that would lift his avoirdupois.

Aeronautic Invention.—The Hon. Edward B. Moore, Commissioner of Patents, spoke on "The Significance of Aeronautic Invention." He told of the great influx of aeronautic patents and showed how the American inventor is earnestly striving to perfect and improve the machines by which we navigate the air. He was followed by Rear Admiral Peary, who spoke of the possible use of the aeroplane for polar exploration; by Capt. Washington I. Chambers, who talked on the "Development of Naval Aviation"; and by Willis L. Moore, who told of the meteorological problems in connection with aeronautics.

Exhibition Flights.—A southern flying machine concern displays with some pride contracts amounting to nearly one hundred thousand dollars for exhibition flights the coming season.

Electricity

Metal Filament Street Lamps in Berlin.—Owing to their economy of operation, metallic filament lamps are beginning to compete with arc lamps for street lighting in Europe. One point in their favor is that the first cost of the lamps is much less than for arc lamps. One of the large German companies proposes a street lighting system for Berlin, using 200 to 400 candle-power lamps hung from wires stretched across the street and spaced along about 150 feet apart.

Austria's Longest Electric Line.—The longest electric railroad in Austria is the 40-mile line running from Trient to Male, and it ranks among the long lines in Europe. It was built especially as an electric road, and is narrow gage, using overhead trolley and working on 800 volts direct current. The motor cars have four 50 horse-power motors, one on each axle. Current for the line is taken from the distant hydraulic station of Sarca on 20,000 volts, this being reduced in three substations along the railroad in order to feed the trolley wire. Freight and postal cars are also used.

The Highest Wireless Station in Germany.—This will be the one which the Bavarian Government is to erect on the height of Zug, and will cover quite a wide radius. During the recent trials of instruments at this point it was found that signals could be taken from the Norddeich wireless plant, these being the time signals which this latter station is now sending out. Owing to its elevated position it is intended to use the Zug post for meteorological work in connection with weather signals. The new plant will be erected this spring as soon as the weather permits.

A German Cable to South America.—It is expected that the first cable from Germany to South America will be completed during the present year. The route is from Emden by way of Teneriffe and Monrovia; thence to Pernambuco. The new cable will serve the double purpose of connecting the German colonies in West Africa with the fatherland, and facilitating Germany's immensely important commercial relations with South America. On the purely scientific side the laying of the cable will yield a series of soundings over a tract of the South Atlantic that has hitherto been little explored.

Marine Cable Disturbed by Trolley System.—Recently it was found that the operation of the syphon recorder of the submarine telegraph cable at Cape Town, South Africa, was interfered with by a trolley line. The shore end of the submarine cable for the length of a mile was at a mean distance of one-half a mile from the trolley line. As a remedy, a second or dummy cable, with an earth plate, was laid as nearly as possible over the old one, and this effectually cancelled the disturbances. Observations made in London have shown that the earth's magnetic field is disturbed over the whole neighborhood of the City and South London Electric Railroad, and in the United States the utility of our magnetic observatories has more than once been threatened by the trolley.

New Norwegian Electric Railroad.—An electric railroad of some interest is soon to be opened in Norway, and the current will be furnished by the great hydraulic plants of Rjukan and Sraelgfos. The railroad has been running for some time with steam locomotives, but it is now being changed over to the electric system. It starts from Nottoden and the first section ends at Tinnoset on Lake Tinn. A steam ferry makes connection across the lake for 20 miles so as to reach the second section, starting on the lake shore at Rollag and ending at Saaheim. The electric railroad will start with the use of five single-phase locomotives of German build, three of which are of 45 tons, 500 horse-power size, and the other two a smaller type of 20 tons and 250 horse-power. The first section of the railroad will use power from the Svaelgfos hydraulic plant and the second section from the Rjukan plant, at 10,000 volts. Since electrochemical industries, notably for nitrogenous products and carbide, are developing around the two hydraulic plants, the electric railroad will handle a considerable amount of freight of this kind.

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Engineering

Progress at Panama.—The grand total of canal excavations to April 1, 1911, was 135,089,432 cubic yards, leaving 47,448,334 cubic yards still to be taken out. The total excavation for March was 3,327,443 cubic yards, as compared with 3,067,479 cubic yards in March of last year, and 3,880,337 cubic yards in March, 1909.

New 15-inch British Naval Gun.—By way of reply to the 14-inch gun which has been adopted by some other navies, the British Admiralty are constructing, we understand, a 15-inch, 50-caliber gun. If the present rate of increase continues, it will not be long before we are back to the 17-inch caliber, which was used in a few monster weapons of 20 years ago that were mounted in certain Italian warships.

The Standpipe Shibboleth.—To place an elaborate standpipe system in a building is merely to begin the work of fire protection. To make it effective, fire drills should be practised regularly. The hose should be unwound, valves opened, and water actually turned on. Else, when the fire breaks out, valves will stick, and hose, rotted through by disuse, will burst. Under such conditions, the finest stand-pipe system is nothing more than a delusion and a snare.

Thousand-foot Dock at London.—The first installment of the proposed improvements which are intended to place London, in respect of its equipment, on an equality with Liverpool, Southampton and other ports, is about to be commenced by the construction, at a cost of twelve million dollars, of the South Albert dock. The entrance lock will be 110 feet wide, 1,000 feet long, with a depth of water of 48 feet, and the works will include a new dry dock of the same length and width, with a depth of water of 38 feet.

Diesel Marine Motors Save Money.—In a vessel of 5,400 tons now under construction, the use of Diesel motors adds 15,000 cubic feet to the hold space. At four voyages a year in the Black Sea trade, this means a profit of $4,380. The saving in fuel would be $2,677, and in wages, $1,168. It is also stated that a fishing boat of 140 tons equipped with a Diesel motor is doing the same amount of work in the herring fisheries as is performed by a steam-driven fishing boat of 164 tons.

A 29-knot Dreadnought.—Time was when the different types of naval vessels were sharply distinguished by their possessing in a marked degree certain individual characteristics of heavy gun fire, massive armor, or high speed. To-day, no such classification is possible, as witness the latest British battleship cruiser "Indefatigable," which carries eight 50-caliber, 12-inch guns, a belt of 9-inch armor, and on her recent acceptance trials of 24 hours' duration, is reported to have steamed at times at a speed of 29 knots.

An Experimental Mine.—The United States Bureau of Mines is carrying on a valuable test at Bruceton, about 12 miles southwest of Pittsburg, where an experimental mine is being driven. Funds were provided by Congress for driving a straight entry from 2,500 to 3,000 feet in length in a seam where great explosions had previously occurred. A parallel entry, called an air course, will be connected with the main entry by cross cuts. Entering the air course diagonally is a "gallery entry," at whose outer end are explosion doors. Beyond them is a round steel gallery 120 feet long, in which coal-dust tests will be made.

Unusually Large Railroad Blast.—On the Lackawanna cut-off between Hopatcong, New Jersey, and Slateford, Pennsylvania, where some of the heaviest cutting and embankment in the history of railroad construction is being done, a huge blast was recently set off which dislodged 19,500 cubic yards of material. A tunnel measuring 4 by 5 feet was driven into the side of the hill and terminated in a cross tunnel of the same section, 91 feet in length. The amount of explosives placed in the tunnel was 21,250 pounds of Judson R. R. P., and 12,000 pounds of 60 per cent Red Cross dynamite. All of the explosive was effective in breaking up and displacing the rock.

Science

Geologists Shipwrecked on Hudson Bay.—An expedition led by Prof. J. Macoun, Assistant Director of the Geological Survey of Canada, while making surveys on the west coast of Hudson Bay aboard the schooner "Jeanie," encountered a severe storm on September 9th, in which their vessel was wrecked. The fifteen men of the party, including the crew of the schooner, after suffering great hardships, succeeded in making their way overland to Fort Churchill, where they arrived December 1st.

Penetrability of Matter.—It is held by more than one high authority that matter is neither continuous nor homogeneous. Thomson showed by an experiment that hydrogen can be passed into a vacuum tube through an incandescent platinum window. In a similar way sodium passes through glass, and this is a useful fact in the manufacture of vacuum tubes, because sodium can be passed into the tube to absorb the residual oxygen. Bellati, the Italian physicist, has shown that hydrogen can pass through cold iron. Matter may therefore be generally regarded as full of holes.

The Life of Mrs. Richards.—Miss Caroline L. Hunt, of 32 Eliot Street, Jamaica Plain, Mass., is collecting material for the life of Mrs. Robert H. Richards of the Massachusetts Institute of Technology. In order that the volume may be of such a character that it may not only interest those who have known Mrs. Richards either personally or through her work, but may also serve to extend her influence and to inspire future workers, any material, such as letters, photographs, characteristic sayings and incidents, which will help to show her personality and her far-reaching interests and activities, would be very valuable to Miss Hunt.

Aerological Research in China.—The *Deutsche Zeitschrift für Luftschiffahrt* announces that an aerological expedition will shortly be sent from Germany to China. A base station is to be established at Peking, where for a year daily observations of the upper air will be made with kites and pilot balloons. The most interesting fact, however, in connection with this undertaking is that two free manned balloons are to be used whenever favorable weather prevails, making ascents from Peking. Although their principal work will be meteorological, it is expected that much important geographical and ethnographical information will be collected by the aeronauts.

Geocoronium.—This name is applied to a hypothetical gas, much lighter than hydrogen, which, according to Alfred Wegener, constitutes a layer of the earth's atmosphere lying above the assumed hydrogen atmosphere. It is analogous to, and possibly identical with, the "coronium" of the solar corona. Wegener believes that the characteristic line in the spectrum of the aurora, heretofore usually attributed to krypton, is due to geocoronium. According to his computation, published in the *Physikalische Zeitschrift*, this gas forms only 0.00058 per cent of the atmosphere, by volume, at sea-level, but at an altitude of 500 kilometers (311 miles) it forms 93 per cent of the atmosphere, the remainder, at that level, consisting of hydrogen.

Stratification of the Atmosphere.—Dr. Alfred Wegener continues his investigation of this subject, which has already led him to some novel conclusions. In the *Physikalische Zeitschrift* of March 1st, he suggests that the presence of well-defined boundaries between atmospheric strata of decidedly different densities (e. g., between the nitrogen and the hydrogen atmospheres) might account for the fact that in the case of certain explosions the sound was inaudible at about 30 kilometers from the source; beyond this distance occurred a "zone of silence" about 100 kilometers broad, and beyond this again another zone in which the report could be heard. This he explains as the effect of total reflection of the sound waves from the bounding surface between air strata. Above the hydrogen atmosphere Wegener finds evidence of the occurrence of an atmosphere consisting chiefly of "geocoronium."

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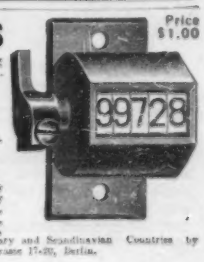

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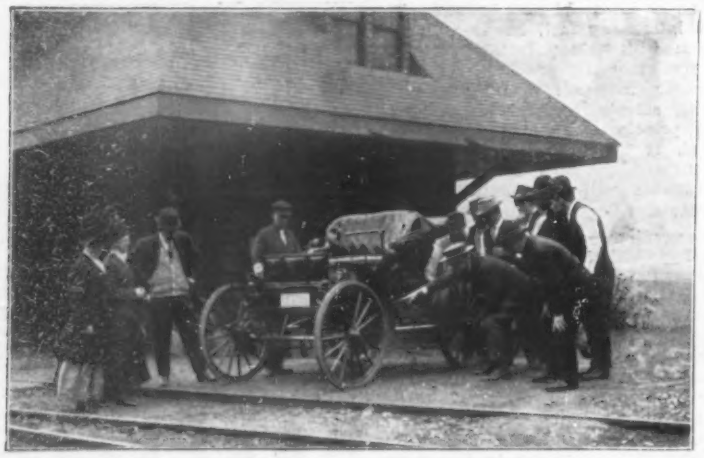

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